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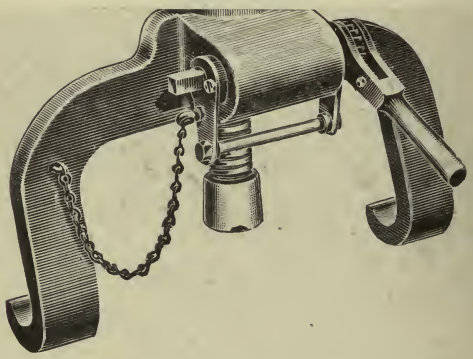

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THE SAFETY OF BRITISH RAILWAYS

OR

RAILWAY ACCIDENTS:

HOW CAUSED AND
HOW PREVENTED.

BY

H. RAYNAR WILSON,

Author of "Mechanical Railway Signalling,"
"Power Railway Signalling."

London:

P. S. KING & SON,
ORCHARD HOUSE, WESTMINSTER.

1909.

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GENERAL

PREFACE.

The Author was led, a few months ago, by an article in a technical journal, to look into the causes of the railway accidents of thirty years or so ago and to compare them with those of the present day. The question of safety on British railways is one of great importance as well as of considerable interest, and this was in the Author's mind when he commenced investigations. We were then passing through anxious times in that direction as the annual report of the Board of Trade showed that the year 1906 was the worst since 1874 as to casualties to passengers in train accidents.

The perusal of these pages will show that the accidents of a former generation were mostly due to a weakness of the Machine and not so much to errors of the Man. The Machine is now perfected, and these pages will, without doubt, force the reader to the conclusion that present day accidents are due to failures of the Man.

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The progress of the equipment of British railways with such safety appliances as interlocking, the block system and continuous brakes, and their effect on the number of accidents may be learnt herein.

The fact, though, that collisions and derailments still occur, though all these safeguards have been universally adopted, adds point to the Author's suggestion that it is the Man and not the Machine that is at fault. The question of the safety of employees cannot be said to have been as well disposed of, but much has been done by the companies who are always willing to consider any complaint or suggestion that will lead to a reduction in the number of casualties.

The Author does not claim that there is anything new in these pages. All the facts and figures can be obtained from the government blue books, but it will be a convenience to many readers to have these in one handy volume. The views of the Royal Commission of 1874, the opinions of former railway officers of note, and of the inspecting officers of the Board of Trade

and the causes of earlier railway accidents and of recent ones should, the Author thinks, be worthy of record.

The fact that since October 26th, 1907, there has not been a single passenger killed in a train accident on a British railway may be another item of additional interest in this subject of The Safety of British Railways.

June, 1909.

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SAFETY OF BRITISH RAILWAYS.

CHAPTER I.

EARLY LEGISLATIVE ACTION.

Railway accidents have often been the subject of Parliamentary debate, inquiry, and of legislative action.

By Section III. of the Railway Regulation Act of 1840 (3 & 4 Vict., Ch. 97), returns of "all accidents which shall have occurred thereon attended with personal injury" were to be sent by the Railway Companies to the Board of Trade.

The Railway Regulation Act of 1842 (5 & 6 Vict., Ch. 55) by Section VII. amended that part of Section III. of the Act of 1840 as to the above returns. The amended powers read "That every Railway Company shall, within 48 hours after the occurrence upon the railway belonging to such company of any accident attended with serious personal injury to the public using the same, report the same to the

Board of Trade." Then in the next Section the Board of Trade were empowered to "order and direct any railway company to make up and deliver to them returns of serious accidents occurring in the course of the public traffic upon the railway belonging to such company, whether attended with personal injury or not, in such form and manner as the Lords of the said Committee (i.e., the Board of Trade) shall deem necessary, and require for their information with a view to the public safety."

In 1853 what has become known as the Cardwell Committee who were appointed to consider the principle of amalgamation as applied to Railway or Railway and Canal Bills, in their fifth report referred to the subject of railway accidents, although it was not specifically named in their instructions. They begin :— "Your Committee have considered with care the subject of safety. The numerous cases of fatal accidents which occurred during the past winter (1852-3) and the judicial investigations which ensued upon them invested this portion of their inquiry with particular interest."

The report then says :—"Several accidents appear to have been due to a neglect of the enforcement of regulations which have been adopted by the directors of railways for the safe conduct of the traffic on their respective lines. Some of these rules are neglected with the full knowledge of the superior officers of the companies. If the rules are superfluous they ought

to be rescinded, and not be neglected by a species of tacit understanding, to be afterwards brought up against individuals should an accident occur, giving rise to investigation. The most fruitful cause probably of accidents is want of punctuality on lines where trains are run according to fixed time-tables. A perfect system of signals, and a strict enforcement of the regulations concerning them, would tend much to lessen this danger. In several instances our inspecting officers have reported a deficiency of brake power, which has caused many accidents. The subject has been mentioned in previous reports which have been laid before Parliament, and appears most worthy of attention on the part of railway companies as involving in a great degree the safety of the public."

They recommended that criminal proceedings for culpable negligence should be taken in those cases where there were no fatal results. "If it be right, as doubtless it is, that the culpable negligence of railway managers resulting in death to a traveller should be manslaughter, there seems no good reason why the same negligence resulting in serious injury or risk of life or limb, should not constitute a crime." The Committee evidently saw a difficulty in the way of getting hold of someone who could be made the culprit, and therefore considered "that in every case some one managing director or other officer appointed by the Company should

be held responsible for the safe conduct of the traffic, and that he should be invested with such authority as might be necessary to enable him to conduct it with efficiency and safety." A resident engineer was to be named as responsible for the state of the line, and a locomotive engineer for the rolling stock "in order that in case of accident from culpable negligence the person in whose immediate department that negligence has occurred might be known." In view of the relations then existing between railways and the Board of Trade the following remark in the report should be noted:—"It must at the same time be remembered that at present the companies generally afford every facility to the officers of the Board of Trade for inquiring into the causes of any accident which has occurred." The report further referred to the need for communication between the guard and driver.

In 1857 a Select Committee was appointed by the House of Commons to enquire into the causes of accidents on railways and into the possibility of removing any such causes by further legislation.

In looking through the report of this Committee, the Author noticed that Capt. Galton, of the Board of Trade, when giving evidence, stated that the East Lancashire and Lancashire and Yorkshire Companies protected their lines by stationing men within sight of each other along the whole length. He further spoke very

highly of the continuous brake used on those lines. This was Fay & Newall's. The report of this Select Committee recommended that the Board of Trade should have powers to inquire into accidents: it stated that in their opinion trains were run at an excessive speed owing to the want of punctuality: it recommended that in order to obtain greater punctuality passengers should be able to obtain redress for unpunctuality: that means of communication be provided between the guards and driver, and the telegraphic block system be extended. The report said also "with respect to day and night signals, brakes and other precautions, your Committee is of the opinion from the evidence which it has heard, that such details are better left to the management of the Railway Boards."

In 1867, a Royal Commission on railway matters was appointed. As in the Cardwell Committee, the Royal Commission referred to safety on railways as an incidental subject, and it was thus referred to in the report, after confirming the recommendations of the Select Committee of 1853, "The marked diminution in the number of accidents which subsequently occurred induced Parliament to postpone any legislation at the time. The figures already quoted in this report show the great improvement which has taken place in the safety of travelling, insomuch that in the year 1865 out of 252 million travellers 23 only met with death by causes beyond their own control. We

believe that no other mode of locomotion ever used by man can show a more satisfactory result, and we are therefore not prepared to suggest any alteration of the present law in this respect. Parliament has relied for the safe working of railways upon the efficiency of the common law and of Lord Campbell's Act which gives persons injured, and near relatives of persons killed, a right to compensation. We consider that this course has been more conducive to the protection of the public than if the Board of Trade had been empowered to interfere in the detailed arrangements for working the traffic."

In 1868 the Regulation of Railways Act (31 & 32 Vict., Ch. 119) was passed. Section XXII. of this reads:—"After the first day of April, one thousand eight hundred and sixty nine, every company shall provide and maintain in good working order in every train worked by it, which carries passengers and travels more than twenty miles without stopping, such efficient means of communication between the passengers and the servants of the company in charge of the train as the Board of Trade may approve."

The Author would here anticipate and say that this was the first and only legislative enactment up to 1889 taken for securing safety in railway travelling. The results of this were not for many years happy, as will be judged from the consideration to the subject given in

Chap. V., and well may Mr. Galt say in his addendum to the Report of the Royal Commission of 1874: "All these extended inquiries that have taken place during the last twenty-five years by Parliamentary Committees and by a Royal Commission as to the best means that should be adopted for their prevention, has only resulted in the passing of one abortive clause in an Act of Parliament—that relating to communication being established between the passengers and guards of a train."

In 1871 was passed the Regulation of Railways Act (34 & 35 Vict., Ch. 78), by which the powers of the Board of Trade as to the inspection of railways were enlarged. By Section 6 the companies were ordered to report to the Board of Trade any of the following accidents:—(1) Any accident attended with loss of life or personal injury to any person whomsoever. (2) Any collision where one of the trains is a passenger train. (3) Any passenger train, or part of a passenger train, accidentally leaving the rails. (4) Any accident of a kind not comprised in the foregoing descriptions, but which is of such a kind as to have caused, or to be likely to cause, loss of life or personal injury and which may be specified in that behalf by any order to be made from time to time by the Board of Trade. The Board of Trade by Section 7 are authorised to hold an inquiry into the cause of any accident, and the Inspector is to make a report thereon, and the Board of

Trade shall cause every such report to be made public in such manner as they think expedient.

In 1871 Capt. Tyler, who was then the Chief Inspecting Officer of the Board of Trade, commenced "An annual general report on railway accidents." This was on the accidents during 1870. This first report was a very lengthy document, and contained comments on most of the accidents of the year, and on the causes that gave rise to them. From this report the Author reads that :—

> In June, 1866, the Midland Company formally protested against being compelled to apply such apparatus (interlocking) before receiving sanction for opening new lines of railway. They stated that in complying with the requirements in this respect of the Board of Trade, they were acting in direct opposition to their own convictions, and they must, as far as lay in their power, decline the responsibility of the locking system.

Subsequent annual reports of Capt. Tyler were not so long. They were similar to those that were issued by the Board of Trade until recently, when they were increased in size, beginning with the annual report for 1903. The ground covered by these reports may be judged by the reference thereto in the report of the Royal Commission of 1874. It says :—

> The reports of Captain Tyler are most able and exhaustive, ranging as they do over every cause of preventable accidents, and pointing out the means in detail by which they might be avoided, yield us a source of information for which we should

look in vain to any other quarter. It should be observed that Capt. Tyler enters into statistical calculations showing the number of deaths and persons injured resulting from accidents, compared with the numbers of the previous years, and noting the increase and decrease in the respective numbers, as the case may be.

Three events of note occurred during the year 1873. The first was the introduction by Earl de la Warre into the House of Lords of a Regulation of Railways (Prevention of Accidents) Bill, for the compulsory adoption of the block system, and the interlocking of points and signals. This was referred to a Select Committee of the House of Lords, who reported thus:—

The Bill provides that these systems shall be universally adopted on all railways within five years from the present time. The arrangements indispensable for the efficient working of these systems throughout all the important lines of the country could not, it is said, be completed within that period. In many cases an entire remodelling of the stations would be required, and as this would have to be accomplished without suspending the traffic, the change, if compulsorily enforced, might be attended with much inconvenience and some danger. A clause might be introduced into the Bill giving the Board of Trade power to prolong the time named in the Act for the completion of these systems. This course would impose on the Board of Trade a grave responsibility during the interval of time conceded to the railway company, and if an accident from collision should occur during the intermediate period, the Board of Trade would be blamed for not having used the power with which Parliament had in-

vested the department. The inspectors of the Board of Trade in their annual reports have called attention to many other measures for the prevention of accidents besides the two mentioned in this Bill. If these two systems were made compulsory, railway companies might rest content with fulfilling the requirements of the law, and be less inclined to expend money on other improvements which, though not enforced by law, may be conducive to public safety. Relying on the great exertions recently and very generally made by different railway companies to extend the block and interlocking systems, and the improvements now in progress, the committee recommend that the Bill should not be proceeded with during the present session. They recommend, however, that the Board of Trade should call for such information as may enable the inspectors in their annual reports to state specially the progress made in their adoption on all passenger lines. Parliament will then be in a position to decide whether or not it would be right to require the further and more prompt extension of these systems on those lines where they are necessary.

As a result, by Section 4 of the Regulation of Railways Act, 1873 (36 & 37 Vict., Ch. 76) the railway companies were to send in on the fifteenth day of February in each year a return —known as the "interlocking return" showing what progress had been made with the block system and the interlocking of points and signals, and what remained to be done.

The next event of note in the year 1873 was the Wigan accident, when the rear portion of the London & North Western tourist train to Scotland, whilst passing through Wigan, on the morning of August 2nd, left the rails.

Thirteen passengers were killed, and 30 were injured. Various suggestions were advanced as to the cause, but it cannot be said that the real reason was discovered. Many were of the opinion that the signalman moved the points whilst the train was passing over, and so the train was split and the direction taken by the derailed vehicles would confirm this. It must, however, be borne in mind that the wheel base of the carriage then in use was very short, and as the train was travelling at a good speed, a rapid movement would be necessary. The conclusion arrived at by the Board of Trade Inspector was that the vehicles were derailed during oscillation in passing over the facing points. The speed of the train was much criticised, and Sir (then Mr.) George Findlay, in giving evidence, said *à propos* of the speed of competing trains:

> There was in London an institution called the Railway Clearing House, and there, besides other bodies, met the passenger superintendents. This question of speed was brought before them at one of their meetings last year. It was thought trains were not so punctual as they might be, and that if more time were given they would be more punctual, to the satisfaction of the public. A specific resolution was moved to this effect, but it was objected to by other companies, who preferred a higher rate of speed, and so no agreement was come to.

In passing, it may be noted that at the inquest Mr. H. A. Ivatt gave evidence. He was the fireman of the limited mail that followed the

unfortunate tourist train, and is described in the report as "a highly intelligent witness."

The Wigan mishap created a great demand for the locking-bar for facing points, whereby the points cannot be moved when any vehicle is on them as the locking-bar has to be raised before the points can be altered in position, and the wheels of any vehicle would be on the bar, and consequently it could not be raised, nor, therefore, the points moved. The bar had then (1873) been invented about six years, and Sir (then Mr.) John Fowler described it as the greatest improvement he was acquainted with.

The Wigan accident again revealed itself in an accident at Syston, on the Midland Railway, the following November, when Col. Hutchinson in his report said :—

> The occurrence of this collision as well as that at Wigan points to the danger of the now greatly prevailing practice of running through facing points at full speed. Until competing companies come to some general understanding upon the reduction of speed at facing points and complicated stations, or until there is a Parliamentary limit to speed laid down, much improvement is not, I fear, to be expected.

In the same month—November, 1873—the Board of Trade issued a circular letter to the railway companies on the subject of railway accidents, and enclosed a copy of Capt. Tyler's annual report for 1872. As the Author considers that this communication should be on

record, if only as a matter of history, he gives it *in extenso*.

Board of Trade, Whitehall Gardens,
18th November, 1873.

Sir,

Her Majesty's Government desire to call the earnest attention of the railway companies to the enclosed Report made to the Board of Trade upon the accidents which occurred on the railways of the United Kingdom in the year 1872, exhibiting as it does a state of things which, it is believed, has been not only continued, but aggravated during the present year.

It appears from the Report that a large proportion of these casualties are due to causes which are within the control of the railway companies. If it may be contended that the traffic on many lines has greatly increased, and with it the risks of railway travelling, it is no less true that it is within the power of the companies to take care that the permanent way, the rolling-stock, and the station and siding accommodation are kept up to the requirements of the traffic; that the officers and servants are sufficient in number and quality for the work to be done, and that proper regulations for their guidance are not only made but enforced; that pains are taken to test every reasonable invention and expedient devised for the purpose of preventing danger; and that such of those expedients as experience proves to be effective are adopted without undue delay.

In the face of the facts collected and analysed by Captain Tyler, and of the numerous accidents of the present year (many of them the subject of Board of Trade inquiries), it is difficult to suppose that such is the case.

There can indeed be no doubt that methods of working and mechanical contrivances, the value of

which has been thoroughly ascertained, have been too slowly introduced; and there is great reason to believe that sufficient provision has not been made for the safe working of the increased traffic by the enlargement or re-arrangement of stations and sidings, and the laying down of additional lines of rail.

But whatever may be thought of these or other causes as contributing to the result, the present insecurity of railway travelling imposes upon the railway companies the grave responsibility of finding appropriate remedies for so great an evil.

In these observations I do not attempt to distinguish between the various companies, to all of which they do not in an equal degree apply.

Another subject which urgently requires attention is the frequent unpunctuality of passenger trains.

The inconvenience, vexation, and loss caused to passengers by this breach of the conditions upon which the companies profess to carry them, constitute in themselves a serious subject of complaint. But the evil arising from unpunctuality does not end here. The service of the line is disarranged, the chances of accident are multiplied; and trains are forced, in order to make up for lost time, to travel at excessive speed through complicated stations, or under other circumstances, where such travelling may be equally dangerous.

The returns made by the companies to the Board of Trade, under a recent Act, of the accidents which happen to railway servants, show a lamentable number of casualties, often fatal, in proportion to the numbers employed.

It is, no doubt, true that many of these accidents are due to the negligence and rashness of the men themselves and to the hazardous nature of their duties. But, at the same time, it is to be feared that the danger of their work is not unfrequently increased by the want of proper accommodation and

appliances, or of suitable means of precaution or protection; while sufficient pains do not appear to be taken to enforce upon them the observance of the regulations made for their safety.

The companies will feel the necessity of seriously considering the means of preventing so great a loss of life.

Her Majesty's Government are fully sensible of the difficulties incidental to railway working in a country where the traffic is so great and so various, as well as of the efforts which have been made by the railway companies, in many respects with remarkable success, for the accommodation of the public; but safety for life and limb, which ought to be a paramount object, has, nevertheless, not been sufficiently secured, and great and increasing dissatisfaction is the result.

Her Majesty's Government, therefore reserving their own liberty to consider at any time the expediency of legislation upon any part of this important subject, have deemed it their duty to call the attention of the railway companies to the whole question, in the hope that they, in whose hands the means of improvement mainly rest, will themselves make every effort to meet the reasonable demands of the public and of Parliament.

I request that you will bring this letter and the accompanying report before your Board.

I am, sir,
Your obedient servant,
C. P. FORTESCUE.

To the Chairman of the ..... Railway.

The replies from the companies form interesting, and, in some cases, amusing reading. Two or three of the greater companies adopted the "mind-your-own-business" attitude, and most of them took the flattering unction home to

themselves that they were included in the exemptions of the sixth paragraph, where Mr. Fortescue says: "to all of which (companies) they (the observations) do not equally apply."

In 1874, Lord de la Warre, disappointed probably at the ill-success of his Bill of the previous year, moved that a Royal Commission be appointed to inquire into the question of the causes of Railway Accidents. This was agreed to, and the Commission was appointed on June 8th, 1874, and reported in February, 1877. The Chairman was the Duke of Buckingham and Chandos, and one of the members was Mr. T. E. Harrison, chief engineer for the Northern division of the North-Eastern Railway.

This subject had better be dealt with in a separate chapter.

CHAPTER II.

THE ROYAL COMMISSION OF 1874.

No less than 336 witnesses appeared before the Royal Commission of 1874, and these included the permanent secretary to the Board of Trade, the four inspecting officers, and the general managers, engineers, locomotive superintendents and traffic managers of most of the railways, and representatives of every grade of the rank and file, who were asked 43,443 questions. The Commission visited the principal railway centres, and were present at the Newark brake trials in 1875.

The report is divided in five parts. Part I. deals with a historical review of what former public inquiries had done, and of legislative action. Part II. deals with the responsibilities of the railway companies. Part III. deals with the number and classes of accidents. Part IV. notices the powers possessed by the Board of Trade, and as to whether it was desirable they should be strengthened or whether some Railway Board should be created that would enjoy the confidence of the public and the railways, and which should have powers to see that the requirements of the Board of Trade were enforced; and Part V. is a recapitulation and concluding summary.

Noticing first Part II., as to the responsibilities of the railway companies. It opens by remarking :—

Large as are the powers now possessed by the Board of Trade and the Railway (and Canal Traffic) Commission in respect of railways, they are so adjusted and so limited as to leave with the companies the undivided responsibility of working their lines."

Further on, we read :—

Upon full consideration we are not prepared to recommend any legislation authorising such an interference with railways as would impair in any way the responsibilities of the companies for injury or loss of life caused by accident on their lines. To impose on any public department the duty, and to entrust it with the necessary powers, to exercise a general control over the practical administration of railways would not, in our opinion, be either prudent or desirable. A Government authority placed in such a position would be exposed to the danger either of appearing to guarantee works, appliances and arrangements which might practically prove faulty or insufficient, or else of interfering with railway management to an extent which would soon alienate from it public sympathy and confidence, and thus destroy its moral influence, and with it its capacity of usefulness.

Attention is then drawn to the fact that the inspecting officers of the Board of Trade did not agree as to how far governmental interference should go. Turning to the evidence, the Author finds that Colonel Yolland, for instance, said that he thought it should be in the power of some board or authority, " making

that Board as practical as you can make it," to cause that when such-and-such things are provided they must be made use of. They should be able to compel railway companies to provide additional accommodation. The companies were to build stations, etc., to their own design, but the suggested Railway Board were to approve, and might give suggestions. Colonel Hutchinson said that he did not see any reason why the Board of Trade should have any additional powers, but that an authority possessed of sufficient technical information might be vested with more power and authority than now exists. Colonel Rich said:—"I think we should have some power greater than we now have to oblige our recommendations being carried out with regard to works for safety which are generally acknowledged to be necessary. There is no doubt that accidents have happened where stations have been reported deficient with reference to signal arrangements and they have been allowed to remain in the same state until some serious accident has happened. We have no power in that matter. I have hardly made up my mind upon the subject. I have a great objection to interfering with the detail working of lines after they have once been opened." The report then goes on to state:—"We desire then at the outset to express our concurrence with the judgment formed upon this point by the Royal Commissioners of 1865 and to record our decided opinion

that any change which would relieve the Railway Companies from the responsibility which now rests upon them to provide for the safety of their traffic, would be undesirable." Further on it is observed:—"We have carefully considered in what way pressure can be brought to bear upon railway companies which make default in these respects, without impairing their responsibility for the safe conduct of their traffic, and we believe that this may be effected by legislation enforcing upon them the adoption of certain recognised improvements and the construction of necessary works while leaving to the Railway Boards themselves the settlement of all matters of detail and administration."

Before dealing with Part III., the Author would repeat the observation made in the previous chapter, that excepting the clause as to Passenger Communication in the Act of 1868, nothing was done in the way of legislation for greater safety of railways until 1889—twelve years after this Royal Commission reported.

In the consideration of Part III. accidents are divided into four classes as follows:—I. Casualties of the kind usually intended by the term "railway accident," in its proper acceptation, namely accidents to trains, causing injury or danger to passengers and railway servants in making journeys by railway. II. Accidents to travellers or intending travellers, from collateral causes, as distinguished from train accidents. III. Accidents to the public using or being upon

railway stations or premises otherwise than as travellers. IV. Accidents to railway servants in the discharge of duties other than those included under the first head.

The Author, when reading through this report, was pleased to unexpectedly find support for his contention, referred to more fully in Chapter III., that the number of fatal cases is not the ground from which to draw conclusions as to the safety of railways, but the number of accidents. The report says:—"What ought to be considered for practical purposes is the number and the characteristics of the accidents of a kind calculated to endanger life and not merely the actual loss of life resulting from them."

Under the head of Class I.—train accidents—the report refers to human fallibility, and quotes what Capt. Tyler said on this subject in his general report for 1872—See Chapter VI. (The Block System). It then says:—"If the railway companies were generally guilty of carelessness in the selection of men to whom responsible duties are entrusted, the public safety would imperatively demand some stringent interference in this respect. But, on the contrary, there is no reason to doubt that remissness in this respect is exceptional and that, as a general rule, the men so employed are the best available in the existing state of the labour market; and it should be added that as a matter of fact, railway servants as a class are dis-

tinguished for their intelligence, respectability and attention to duty. Moreover, it must not be forgotten that although the number of accidents attributable to men in charge of trains is large in proportion to the number reported in any other category, yet the instances in which these are justly chargeable with error or neglect are not numerous considering the constancy and range of their duties. Then again the mechanical appliances upon which the safety of the trains so largely depends are capable of definite and frequent improvements but, save in so far as new inventions tend to obviate the need of human interference, the dangers arising from human fallibility must continue to be constant and unavoidable. No amount of care in the selection of railway servants and the distribution of their duties can secure immunity from occasional acts of negligence or error, and we are of opinion that the public safety would not be increased by any direct legislative interference in this respect."

The block system is said to have excited much controversy, and that some difference of opinion still existed in relation to it, but that the weight of evidence in its favour was very decided and constantly increasing. The objections that had been urged against the interlocking of points and signals had, however, no weight whatever. The Royal Commission found that the exertions noted by the Select Committee of 1873 had been continued, but that they considered that the

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time had come when compulsion ought to be resorted to in exceptional cases where remissness was apparent.

Much was said as to the want of punctuality, and this is noticed in Chapter V.

Insufficiency of accommodation was often the real cause assigned in former Board of Trade reports on accidents, and considerable attention is paid to this subject in the report of the Royal Commission. Statistics are given showing how the traffic had grown, and especially between 1872 and 1875 and from these figures one can readily understand how the traffic grew quicker than the accommodation increased. On this subject the Commission say:—"We consider immediate legislative interference desirable and necessary in this matter and we recommend that powers be conferred on the Board of Trade to enable that department to enforce the execution of necessary works wherever the deficiency of station or siding accommodation is such as as to endanger the public safety. The continuance of the state of things supposed is a direct violation of the obligations contracted by the companies in obtaining Parliamentary sanction for their undertakings and therefore a fit case for Parliamentary interference."

The questions of passenger communication and of continuous brakes are, of course, referred to, but these are noticed in subsequent chapters (V. and VIII.), under these heads.

Defects in rolling stock, especially of the fail-

ure of tyres, are mentioned, and as to the permanent way the report says:—"The most obvious and simple condition is that the permanent way should be in perfect order. There may be uncertainty and doubt in respect of other precautions not less necessary; drivers and signalmen may fail in the vigilance required in the performance of their duty; wheels and axles may suddenly give way or locomotives may break down from some latent and undiscovered weakness, but there can be no difficulty in ascertaining almost day by day the state of the rails, sleepers, points and gauge of the permanent way. It is simply a matter of inspection and necessary repair, to neglect which is a direct breach of the company's contract with the public."

The remarks as to Class II. deal principally with those passengers who were killed and injured getting in and out of trains, and refer to continuous footboards. This subject is therefore dealt with in Chapter V., and as Class III. refers to Trespassing chiefly, the opinions of the Royal Commission thereon are noticed in Chapter XVI.

Coming now to Class IV., which may be said briefly to refer to accidents to servants. The first remark on this subject is a recommendation —adopted within the last few years—that some distinction should be made as to the extent of the mishaps to injured men—whether they are serious enough to incapacitate them from work,

or of a mere trifling nature. Further on we read:—"It must not be forgotten moreover, that this loss of life is, in a large measure, owing to the recklessnes of the men themselves. Familiarity with railway work produces of necessity disregard of danger, and practices involving special risks are habitually resorted to on the ground of convenience. Indeed, according to the returns supplied by the companies to the Board of Trade, more than nine out of ten of the fatal accidents to railway servants are attributed to the misconduct or want of caution of the sufferers, only 238 deaths out of the total of 2,960 (for four years) having been returned as occurring from causes beyond their own control."

A memorial was sent to the Royal Commission from the Amalgamated Society of Railway Servants on this subject, and especially on the question of employers' liability. This and the comments of the Commission thereon is noticed in Chapter XVII.

Part IV. of the report of the Royal Commission dealt with the powers of the Board of Trade. Reference has already been made to suggestions that a tighter hold should be maintained over railways. This part of the report then begins:—"We have taken into consideration the suggestion that a special board should be constituted to exercise functions similar to those now possessed by the Board of Trade under the Regulation of Railways Acts. . .

We think it undesirable that a new executive authority should be constituted to administer the Acts now in force or the additional provisions we recommend. The Board of Trade possesses an efficient and experienced staff for this purpose, and we regard it as of great importance that whatever powers of control Parliament may think fit to establish should be confided to a government department possessing undoubted weight and authority and presided over by a responsible minister who can explain and defend its proceedings in Parliament."

A little further on reference is made to the happy results of interviews that took place in the summer of 1876, between Mr. George Leeman, M.P., the Chairman of the North-Eastern Railway, and Chairman of the Railway Companies' Association, and Sir Charles Adderley, M.P., the President of the Board of Trade, when it was agreed that conferences should, when special questions of difficulty or doubt arose, be held between representatives of the Association and of the Board of Trade. It was suggested that, as representatives of the Association, there should be in each case a director of eminence, and, according to the merits of the case, an engineer, traffic manager, or working superintendent, &c., and that the Board of Trade would appoint one of their secretaries, or assistant secretaries, and two or more of their inspecting officers. The report says of this agreement:—"We believe that

this result will be important not only as a means of rendering the duties of the government inspecting officers more easy and practically more beneficial but also in establishing greater freedom of inter-communication between the officers of the various companies. The judgment of such persons in matters of which they have special knowledge of an experimental kind cannot fail to be useful and the combined experience of representatives of different railways and their opinions given after conference with one another will be of still greater practical value. We attach great importance to this scheme not as rendering legislation less necessary but as facilitating the administration of statutory provisions for the regulations of railways."

As the recapitulation of the report is not only interesting, but of great value, the Author gives it in full:—

We find that in former inquiries of this kind great stress has been laid upon the responsibility which the law imposes on railway companies to provide for the safety of their traffic, and we are unanimous and decided in our opinion that no legislation is desirable which would impair that responsibility.

But we have come to the conclusion that some measures of a definite and decided character are necessary to afford the public additional safeguards against the preventable dangers of railway travelling. In some instances, moreover, the general recommendations of the report would have assumed the form of distinct proposals for legislation, but that we feared lest we should thereby endanger this principle of the undivided responsibility of com-

panies which we regard as of fundamental importance.

To facilitate our deliberations we have adopted a fourfold classification of railway accidents,—I. Accidents to trains; II. Accidents to travellers from collateral causes; III. Casualties to persons other than passengers or servants; IV., General accidents to railway servants.

From our investigation of the causes which contribute to produce accidents to trains, we find that among the most and frequent is the fallibility of railway servants. Although this element of danger cannot be eliminated, we believe it may be considerably modified by the general adoption of the various improvements we have specified.

While in practice the absolute block system by no means gives immunity from the dangers it is meant to guard against, we find that the weight of evidence in its favour is decided, and we recommend that the Board of Trade be empowered to enforce its adoption wherever the department considers such a change to be necessary for the public safety.

Without any reservation, we recommend that the adoption of arrangements for the interlocking of points and signals be similarly enforced, unless where exceptional circumstances may seem to render it unnecessary.

We are of opinion that unpunctuality in the conduct of the traffic is a contributory cause of accidents on railways, but we think it would be impracticable to enforce punctuality by direct legislation, and we recommend that, with this object, additional facilities be afforded to the public to obtain redress by cheap and summary process when trains are late.

We consider that insufficiency in the accommodation provided for the traffic is a great element of danger on railways. We find, moreover, that in some instances this evil has arisen from the action

of Parliament in sanctioning the intrusion of one company on the line of another, without enquiring whether the accommodation upon the old line was sufficient for the increased traffic thus brought upon it, and we recommend that, in future, railway Bills of this kind be made subject to a standing order, similar to that which now regulates Bills authorizing level crossings upon railways, and, further, that if the intrusion be permitted, the responsibility to make further extensions which a subsequent growth of traffic may render necessary, shall be clearly defined, and power given to any company under such responsibility to compel other companies using its line to contribute to the cost of the works required, or to submit to arbitration in the matter.

But our inquiries have satisfied us that more than this is needed, and that a power ought to be created to enforce the execution of necessary works wherever public safety is endangered by deficiency of accommodation, and we recommend that the administration of statutory provisions for this purpose be entrusted to the Board of Trade.

We are strongly of the opinion, however, that if in the exercise of these powers the Board should make requirements which the companies concerned consider unnecessary or excessive, an appeal ought to lie from the order of the department, and it is of the highest importance that the ultimate decision of such cases should rest with some tribunal possessing the confidence both of the railway interest and the public.

We think it is both just and expedient that companies should receive additional facilities in the way we have indicated for acquiring land and raising capital to enable them to carry out the works declared to be necessary under these powers.

We recommend that the enactment requiring railway companies to provide an efficient means of communication between the passengers in a train and

the servants in charge of it, be amended by extending its application and abolishing the limitation which requires that the mode of communication adopted should be approved by the Board of Trade.

We are of opinion that the amount of controlling power generally supplied with trains is at present insufficient, and we recommend that companies be required by law to provide every train with sufficient brake-power to stop it absolutely within 500 yards at the highest speed at which it travels, and upon any gradient on the line. We recommend the fitting of brakes upon engines, and we think it of great importance that a large proportion of the general brake power of the train should be under the control of the driver.

We also desire to commend to the companies the importance of adopting a wheel of such construction that the liability of the tyre to fly off in case of fracture will be reduced to a minimum.

The proper maintenance of the permanent way of railways is so essential to safety that having regard to exceptional cases of neglect in this matter, we recommend that the Board of Trade be empowered, if satisfied by an inspection of the line that it is in a dangerous condition, to prohibit the company from running trains upon it beyond a specified speed. We are of the opinion, however, that the railway companies ought to have a right of appeal against the orders of the Board of Trade in this matter, and also in respect of the compulsory adoption of the block and interlocking systems, similar to that which we have recommended in cases where the department directs the extension of railway works.

We believe that crossings of one railway over another on the level to be an unnecessary source of danger, and we recommend the Legislature not to sanction them in future. Where they already exist, comparative safety may be attained by requiring the crossing lines to be worked on the block system

with signals interlocked at the point of contact, and both lines blocked back for an adequate distance, and we recommend that this be insisted upon in every case.

In dealing with accidents to passengers from collateral causes, our attention has been specially called to cases of persons falling between carriages and platforms, and we recommend that the Board of Trade be authorized to enforce the adoption of continuous footboards as the only practical means of prevention we can suggest. The irregularity in the height of the platforms upon different lines is objectionable, and the attainment of uniformity in this respect is very desirable.

We find that casualties to passengers in crossing the line at stations are numerous, and when these are due to the want of proper footbridges or subways we think that the Board of Trade should be empowered to compel companies to supply the deficiency.

With reference to accidents in the third class above specified, we propose that railway companies should be empowered to enforce penalties against trespassers on the permanent way, without giving proof of the warning now required under the Regulation of Railways Act, 1868.

And having regard to the returns of casualties occurring upon the authorized level crossings for foot-passengers, we recommend that the Board of Trade be empowered to require a lodge to be maintained at any such crossing where the circumstances are such as to render that protection necessary; the company having the option to provide a subway or footbridge as an alternative.

The conditions and duties of railway servants have occupied a considerable share of our attention, and we desire to express our opinion that it would be inexpedient that the Legislature should attempt to interfere directly with railway labour; but we recommend that railway companies be made liable

to their servants for the negligence of those to whom, in the various branches of railway employment, the master's authority is delegated.

In this connection we think some provision defining more clearly the criminal liability of railway servants for acts of negligence is desirable, and we recommend a general enactment in terms similar to those of the 17th section of the 5 and 6 Vict. c. 55, that any person in the employment of a railway company "who shall wilfully, maliciously or negligently do, or omit to do, any act whereby the life of any person passing along or being upon such railway or the works thereof, shall be or might be injured or endangered," shall be liable to a penalty or a summary conviction.

In view of the great loss of life among the servants engaged in shunting operations on railways, especially in fly-shunting, and also among the men employed in repairing the permanent way, and in fog-signalling, we desire to call the earnest attention of the companies to the need of improving their arrangements and regulations in yards, and of providing proper spaces for the safety of men working on the line in all places where there are more than two lines of rails. We would also urge the importance of adopting a uniform code of signals upon all railways.

We wish to record our approval of the bye-law respecting refreshment rooms at stations which we have recited in the report, and we urge upon railway companies the importance of enforcing it, and at the same time of providing accommodation for their servants to obtain suitable refreshments.

We are of the opinion that in the administration of the new powers proposed to be conferred upon the Board of Trade all matters of detail, such as the length of the block sections, the particular form of appliances for interlocking signals and the best kind of brake to be used, should be left to the railway companies themselves.

We recommend that the practice which the Board of Trade has adopted of demanding certificates from companies as a means of imposing conditions in sanctioning the opening of their lines in certain cases be recognised by statute, but that jurisdiction be given to the appellate tribunal to hear appeals against the demands of the Board in this respect, and to set aside conditions which, in the opinion of the court, are unreasonable or unnecessary for safety.

And with a view to the better administration of certain of the foregoing provisions, we recommend that a judicial tribunal be constituted with the necessary qualifications and powers to enable it to review the action of the Board of Trade in respect of the various matters we have specified as entitling railway companies to an appeal.

CHAPTER III.

SOME FIGURES.

It being partly the purpose of this work to show how much safer British railways are now as compared with 30 or 35 years ago it is necessary, in order to arrive at a proper comparison, to note how the volume of the travelling public has increased so as to obtain an average as to the safety enjoyed by travellers. To ascertain the conditions under which employees labour only one set of figures are available. These are the total mileage run. Reference is here being made, of course, to casualties through train accidents, and in the case of employees, goods trains as well as passenger must be considered. As a matter of fact, by taking the mileage a more accurate result is arrived at, because, whilst the passenger total gives an idea of the number who have travelled it is not an index of the volume of the traffic; as in this respect a passenger going from Victoria to Clapham Junction—2 miles—is of the same value as one from Euston to Glasgow—400 miles. It may be a doubtful point as to the worth of ton-mile statistics, but it is certain that the American practice of giving passenger-miles and ton-miles gives a better idea of the volume of traffic.

TABLE I.

Year.	No. of Passengers carried, exclusive of season ticket holders.	Train Mileage	No. of Passengers in Train Accidents.		Proportion of Passengers in Train accidents to No. carried.		No. of Servants in Train Accidents.	
	Millions.	Millions.	Killed.	Injured	Killed, 1 in every Millions	Injured 1 in every Millions	Killed.	Injured
1872	422	190	19	1233	17	·342	42	214
1873	455	197	38	1504	11	·302	29	228
1874	477	200	86	1613	5	·296	46	271
1875	506	209	17	1212	29	·418	21	239
1876	538	215	38	1279	14	·420	28	236
1877	551	219	11	664	50	·830	22	154
1878	565	222	24	1173	23	·481	15	156
1879	562	225 Including Tay Bridge	75	602	7	·934	8	118
		225 Excl. of Tay Bridge	2	602	281	·934	4	118
1880	603	240	29	904	20	·668	23	118
1881	622	248	23	987	27	·630	19	168
1882	654	257	18	803	36	·815	21	153
1883	683	268	11	662	62	1·032	11	87
1884	694	272	31	864	22	·804	23	115
1885	697	274	6	436	116	1·599	13	81
1886	725	277	8	615	90	1·179	4	81
1887	733	282	25	538	29	1·363	8	109
1888	742	291	11	594	67	1·250	7	93
1889	755	303 Including Armagh	88	1016	8	·762	4	117
		303 Excl. of Armagh	8	754	96	1·028	4	115
1890	817	313	18	496	45	1·648	12	147
1891	845	323	5	875	169	·966	12	154
1892	864	327	21	601	41	1·438	9	92
1893	873	322	17	484	51	1 804	10	73
1894	911	333	16	347	56	2·626	6	62
1895	929	338	5	399	185	2·330	12	88
1896	980	353	5	388	196	2·526	3	153
1897	1030	367	18	324	57	3·180	9	140
1898	1062	380	25	632	42	1 681	16	110
1899	1106	396	14	693	79	1·596	19	196
1900	1142	402	16	863	71	1·323	24	180
1901	1172	398	Nil	476	—	2·463	8	156
1902	1188	399	6	732	198	1·623	4	110
1903	1195	394	25	769	47	1·554	9	146
1904	1198	397	6	534	199	2·244	7	114
1905	1199	400	39	396	30	3·027	6	112
1906	1240	414	58	631	21	1·965	13	140
1907	1259	428	18*	534†	70	2·300	13	236

* Nil in 1908 † 283 in 1908

If reference be now made to Table I., the growth in the number of passengers who have travelled by rail and the increase of train mileage will be appreciated. The reason the Author has chosen 1872 as the commencing year is that in 1871 was passed the Act of Parliament on which there has to be reported to the Board of Trade not only all accidents involving personal injury but accidents and failures connected with the road and rolling-stock.

It will be seen that the number of passengers during the last 35 years has grown from 422 millions to 1,260 millions, and has nearly trebled itself, and the mileage from 190 millions to 428 millions, or more than double. The casualties to passengers in train accidents is a very variable quantity, and is determined more by the seriousness of accidents than by the number, at least such is the case at the present day. The number of servants killed and injured by train accidents does not vary much, and, no doubt, is in proportion also to the extent of the accident.

From Table I., it will be seen that the last three years (1905, 1906, 1907) have been bad ones. In the 39 passengers killed in 1905, five met their death in the collision at Cudworth, twenty-one in that at Hall Road, and ten in the derailment at Witham. Of the 58 passengers killed in train accidents during the year 1906, the three accidents at Salisbury (24), Grantham (11), and Elliot Junction (21), account

for 56, and of the eighteen killed during 1907, eleven were killed at Shrewsbury. The figures for 1906 were really the worst since 1874, when 86 passengers were killed in train accidents. It is true that 88 lost their lives in 1889, but of these 80 were killed in one accident—that at Armagh—and that 75 were killed in 1879, which was, however, the year of the Tay Bridge disaster, which year, otherwise, would have had only 2 fatal cases, and thus been the best on the whole list, except the year 1901, when not a single passenger was killed in a railway accident. That unfortunate year, 1874, saw two of the worst railway accidents on British railways—the derailment at Shipton-on-Cherwell (34 killed), owing to a broken tyre, and the collision of two opposing trains on a single line at Thorpe (25 killed). But even 1874 was apparently not as black as it was painted, judging from Captain Tyler's annual report for that year to the Board of Trade. He said:—"The results of the past year are, however, subject to the above observations, more satisfactory on the whole than those of the years immediately preceding it; as showing that the improvements which have been required and which have been and are being very much, in consequence of public attention having been drawn to the subject, more or less rapidly introduced, are already bearing fruit; and as holding out the hope of happier results in future years as these improvefents become more complete. In the face of

an increase of traffic there has been a marked diminution as compared with 1873, in the number of accidents under each of the above classes, excepting as regards collisions between trains meeting in opposite directions and collisions at junctions. These also may be expected to diminish when the systems of working and protection elsewhere described become better appreciated and more generally applied."

TABLE II.

Year.	No. of Collisions and Derailments.	Proportion 1 for every Million Miles run.	Year.	No. of Collisions and Derailments.	Proportion 1 for every Million Miles run.
1876	470	·458	1892	156	2·101
1877	345	·637	1893	189	1·708
1878	306	·726	1894	124	2·685
1879	272	·830	1895	167	2·029
1880	265	·909	1896	214	1·651
1881	298	·833	1897	188	1·956
1882	229	1·126	1898	168	2·263
1883	218	1·233	1899	291	1·361
1884	216	1·262	1900	299	1·344
1885	210	1·308	1901	276	1·445
1886	220	1·259	1902	223	1·792
1887	174	1·625	1903	235	1·676
1888	186	1·565	1904	217	1·829
1889	201	1·508	1905	199	2·014
1890	216	1·451	1906	239	1·733
1891	235	1·377	1907	277	1·740

This leads up to a remark that the Author has always contended that the real test as to the safe working of railways is to be judged from the number of collisions and derailments in proportion to the mileage. There is therefore

given in Table II. the number of collisions and derailments, and the mileage for each year and the average number of miles run to one such mishap. If the test here suggested be accepted as the best criterion, then there is shown the fallacy of determining this by the number of deaths to passengers as the two results do not often agree, for the simple reason already given, that in the present day, the extent of an accident determines the unfortunate results more than the number of accidents. Look, for instance, at the year 1894, in Table II. It has the best record in the list—2,685,684 miles run for one collision or derailment, and yet in that year 16 passengers lost their lives in train accidents. The year 1898 is the next best record, yet 25 passengers were killed that year. And, again, 1905, whose record as to the number of collisions and derailments has only been excelled four times, had the worst record for fatalities to passengers up to then since 1874, (excepting the Tay Bridge and Armagh years).

The increase in collisions and derailments during 1907 as compared with 1906 is due to the fact that such were not reported prior to January 1st, 1907, if passenger trains were not concerned.

CHAPTER IV.

CAUSES OF FORMER ACCIDENTS.

By "former accidents" is meant the accidents of 30 or 35 years ago. It must be borne in mind that at that period the use of the block system was not universal, nor was the concentration and interlocking of points and signals. Automatic and continuous brakes were only just emerging from the clothes of infancy, and there were many accidents due to the old-fashioned method of fastening tyres to the wheels, and for the want of continuous footboards.

As to the use of the block system, the figures in Table III., compiled from the Board of Trade returns, will show what had been done then.

TABLE III.

Year.	Total Mileage opened for Passenger Traffic		Mileage worked by Telegraph			Mileage worked by Telegraph but not on either of the foregoing systems		Mileage on Single lines on other systems than foregoing		
			Absolute Block		Permissive Block					
	Double	Single	Double	Single in addition to Train Staff	Double	Double	Single in addition to Train Staff	By one Engine in Steam	By Train Porter	By Train Staff
1873	8321	6462	4212	2004	297	1506	610	485	52	3251
1874	8822	7045	4969	2461	283	1555	479	511	61	3481
1875	8876	7249	5582	2608	272	1149	695	451	53	3172

From the above it will be seen that during the two years ending December 31st, 1875, there had been 555 additional miles of double line opened, and 1370 more miles of double line

had been equipped with the absolute block system. During the same period there had been 787 additional miles of single track opened, with an increase of 604 more miles of single track equipped with the block system. These latter figures are hard to understand, as not only were there fewer miles of single line equipped with the block system, but the totals for those controlled by the train-staff and other systems were also less.

The state to which points and signals had been concentrated, i.e., the levers put together in a locking-frame instead of being scattered about—and interlocked, will be judged from the figures in Table IV., which are also taken from the Board of Trade returns.

TABLE IV.

Year	No. of cases in which the usual requirements of the Board of Trade Inspecting Officers have, or have not, been complied with in relation to:—					
	Concentration of Point and Signal Levers		Interlocking of Point and Signal Levers		Addition of Safety Points in the case of Goods Lines and Sidings	
	Have	Have not	Have	Have not	Have	Have not
1873	11,087	13,136	10,828	13 575	8,889	9,051
1874	13,933	11,937	13,562	12,767	10,468	7,872
1875	15,276	10,876	15,239	13,275	11,734	7,041

From the above figures it will be seen that during the two years ending December 31st, 1875, there was an increase of 1,929 in the number of places where points and signals could be concentrated, and there were 4,189 more

places concentrated. There was an increase of 4,111 places where points and signals could be interlocked, and of 4,411 places so interlocked, and an increase of 835 cases where safety points were necessary, and an increase of 2,845 cases where they had been provided.

Some companies had made greater progress than others, and from the following figures for the year ending December 31st, 1873, it will be seen that the absolute block system was provided throughout the whole of the lines of ten companies, and that all the points and signals on the Metropolitan and Metropolitan District had been concentrated and interlocked, and the block system established throughout.

	Length of Double Line.	Worked on the absolute Block System.	Points and Signals Interlocked.	Points and Signals not Interlocked.
	miles			
London and North Western ...	1119	573	1952	1418
Great Western	799	311	1179	1398
North Eastern	805	298	1383	1072
Midland	768	506	1128	1051
Great Northern	509	280	138	149
Lancashire and Yorkshire ...	362	88	851	864
Manchester, Sheffield and Lincolnshire	220	31	98	482
Great Eastern	433	159	466	1154
London and South Western ...	436	376	578	330
Caledonian	438	133	192	250
North British	373	78	324	1240
South Eastern	335	All	232	436
London, Chatham & Dover ...	134	All	113	152
London, Brighton & South Coast	278	All	290	303
North London	—	All	—	—
North Staffordshire	—	All	—	—
Bristol and Exeter	—	All	—	—
Furness	—	All	—	—
London, Tilbury & Southend ...	—	All	—	—
Metropolitan	—	All	All	Nil
Metropolitan District ...	—	All	All	Nil

In Table V. is given the total number of casualties to trains during the years 1872-3-4-5, and the number of passengers and servants killed and injured thereby. The Author would have liked to directly compare these figures with those of the present day, but as the headings are somewhat different now this is not practicable, but the reader may make some comparisons by referring to the Table on Page 35. Suffice for the moment to say that if the upper two headings are regarded as train accidents, it will be found that during the four years, 1872-5, there were 2,869 such accidents, or an average of 717 per annum. During 1906, with double the train mileage, there were 487 such accidents; but if the cases of trains running through gates and into cattle and other obstructions are omitted, the average figures for 1872-5 are 497, and the figures for 1906 are 239.

The information given under the lower fifteen headings of Table V., which may be regarded as failures of road or rolling-stock cannot be regarded as conclusive. It will be seen that in 1875 there was a sudden increase under most of these headings, which can only be accounted for by more complete reporting by the companies of such failures. An average of the four years seems hardly fair, and it would seem that a just criterion would be to take the figures for 1875 as being representative. There were, then, 1,977 such failures during 1875, but in 1906, with the train mileage doubled, only 670 such failures.

TABLE V.

	1872.					1873.					1874.					1875.				
	No. of cases	Passengers		Servants		No. of cases	Passengers		Servants		No of cases	Passengers		Servants		No. of cases	Passengers		Servants	
		K	I	K	I		K	I	K	I		K	I	K	I		K	I	K	I
Collisions between passenger trains or parts of passenger trains	55	...	414	...	16	51	3	349	2	23	55	23	371	5	15	55	10	221	...	12
Collisions between passenger trains and goods or mineral trains, engines and vehicles standing foul	163	15	482	7	79	155	8	730	2	77	183	20	804	8	88	179	2	678	1	63
Collisions between goods trains or parts of goods trains...	33	...	...	15	34	45	...	7	11	47	75	...	4	10	65	77	...	11	5	60
Collisions between two engines ...	5	.	...	...	6	2	...	...	1	2	6	...	...	1	5	7	...	...	...	5
Passenger trains or parts of passenger trains leaving the rails	96	3	152	...	14	85	15	104	4	19	97	1	50	2	7	87	2	87	2	12
Goods trains or parts of goods trains, engines, etc., leaving the rails ...	31	...	...	10	17	35	...	...	5	12	74	...	...	7	26	60	...	1	4	5
Trains or engines travellin in the wrong direction through points being set improperly...	37	...	48	1	14	41	...	98	3	14	40	...	121	...	18	75	1	51	2	25
Trains running into stations or sidings at too high a speed	13	...	73	...	5	20	...	119	1	6	21	...	69	...	..	29	...	54	...	4
Trains running over cattle or other obstructions on line	115	...	6	...	...	102	3	36	...	...	195	1	8	4	4	283	...	8	1	2
Trains running through gates at level crossings	31	...	...	1	...	25	...	...	1	1	52	.	...	...	...	79	...	...	1	4

TABLE V.—*Continued.*

	1872.			1873.			1874.			1875.		
	No. of cases	Passengers K	Passengers I	Servants K	Servants I	No. of cases	Passengers K	Passengers I	Servants K	Servants I	No. of cases	Passengers K	Passengers I	Servants K	Servants I	No. of cases	Passengers K	Passengers I	Servant K	Servant I
Failure of boilers or tubes of engines	8	...	...	5	8	5	...	...	...	10	6	...	...	2	6	20	...	...	...	23
,, machinery, springs, etc., of engines	16	...	20	1	3	12	...	2	...	1	8	...	...	...	2	14	...	...	...	2
,, tyres	62	1	8	...	...	30	5	29	1	11	55	34	66	...	7	660	...	16	1	2
,, wheels	11	...	...	...	...	5	...	...	...	...	13	...	..	...	...	112	...	...	...	...
,, axles	162	...	1	...	...	133	4	19	...	7	229	...	8	1	5	478	...	...	...	5
,, brake apparatus	1	...	...	...	...	1	...	...	...	...	1	...	5	...	...	6	...	8	...	...
,, couplings	13	...	17	2	10	3	...	2	...	...	23	1	76	4	11	29	3	40	1	5
,, ropes used in working inclines	3	...	...	...	...	...	...	...	...	...	3	...	...	...	...	7	...	...	.	2
,, tunnels, bridges, viaducts, culverts, etc.	3	...	...	...	1	...	...	...	...	...	4	...	...	...	2	5	...	...	.	1
Broken rails	217	...	4	...	...	204	...	...	...	...	493	...	16	...	.	476	...	...	...	1
Flooding of portions of the permanent way	7	...	...	...	1	2	...	...	...	...	10	...	...	...	..	88	...	...	...	...
Slips in cuttings or embankments	31	...	7	...	4	10	...	...	...	2	8	...	...	...	...	17	...	3	2	3
Fires in trains	20	...	...	...	...	24	...	8	...	...	28	...	...	...	...	21	...	...	1	...
Fires at stations or involving injury to bridges or viaducts	1	...	...	...	...	5	...	...	...	...	12	...	5	...	1	8	..	1	...	...
Other accidents	11	...	1	...	...	6	...	1	...	1	11	...	1	2	9	36	...	33	...	5

The comparison between 1872-5 and 1906 made on p. 46 would appear to at all events point to the fact that the rolling stock and general machinery of railways are very much better now-a-days. As to collisions and derailments, it would seem that these still occur, but that there was in 1906 only one for every 1,733 thousand miles run, as compared with the figures for 30 years ago, which were about 1 for every 402 thousand miles run.

CHAPTER V.

CONTINUOUS FOOTBOARDS. BROKEN TYRES. PASSENGER COMMUNICATION AND WANT OF PUNCTUALITY.

These are four subjects that were often referred to in former Board of Trade reports, but as they no longer figure as causes of accidents they may soon be disposed of.

The question of continuous footboards was prominent owing to the large number of passengers who were killed and injured by falling between the carriages and platforms. The following are the figures under this head for the years 1872-1875.

		Killed.	Injured.
1872	...	48	53
1873	...	62	63
1874	...	49	68
1875	...	43	105

These are very serious figures, especially when compared with the year 1907—27 killed and 157 injured. The large number of fatal cases was undoubtedly due to the use of the iron step, which Captain Tyler, in his evidence before the Royal Commission, said was "admirably adapted to cut people to pieces between the train and the platform."

This iron step was a relic of the earliest railway carriages, and was copied from the road coaches. In entering the carriage, passengers stepped off the ground on to a lower step—which was continuous, or, at all events, sufficiently long—and then on to the upper step, and thence into the carriage. As long as the platforms were low, the upper and lower steps were necessary, and it was also practically impossible to step from an upper continuous footboard on to the lower. So that until the platforms were raised to their present height, the iron step was considered necessary in order that passengers could pass readily from, and on to, the lower. Another objection urged by some companies against an upper continuous footboard was that it would prevent ready access to the axle-boxes. There were grounds for this objection, but, of course, they were overcome by a hinged opening being made.

On August 6th, 1878 a circular to the railway companies was issued by the President of the Board of Trade, drawing attention to the fact that during the year 1877 50 passengers were killed, and 87 were injured by falling on the platforms, ballast, etc., in getting in or out of trains. The letter, after remarking "whilst the Board of Trade are most anxious to avoid, as far as possible, interference with the details of the arrangements of the companies in these matters, or to urge alterations for the mere sake of ensuring uniformity, they consider themselves

compelled in the performance of the duties which Parliament has imposed upon them in the interest of the public to satisfy themselves that all reasonable and acknowledged precautions are taken to prevent unnecessary danger," asks for information as to what had been done *re* continuous footboards, and whether or no the platforms had been raised to the standard height.

The replies from all the companies state that they were making their platforms to comply with the Board of Trade requirements, viz., 2 ft. 6 ins., above rail level.

Many serious accidents occurred in former days owing to fractures of the wheels, and the tyre coming off. The terrible disaster at Shipton-on-Cherwell, already referred to, when 34 passengers lost their lives on the Christmas Eve of 1874, was due to this cause. It used to be the practice to bore holes through the tyre, and fasten the wheel thereto by bolts or rivets. As the tyres wore, these fastenings weakened, but a remedy was found by using clips on each side of the wheel on which were pieces that dovetailed into the tyre, and so held tyre and wheel together. The adoption of a wheel with the recesses between the hub and the spokes and the tyre, filled in with wood—as in the Mansell wheel—has greatly reduced the number of failures of wheels. Now, instead of 660 failures of tyres, as in 1875, there are 172 (in 1907) and only 8 failures of a wheel instead of 112, as in 1875.

It will be remembered that in Chapter I. p. 6, it was stated that in 1868 it was ordered that "efficient means of communication" between the passengers and the servants of the company in charge of the train was to be provided in every train, carrying passengers, that travelled more than twenty miles without stopping. The Act said: "As the Board of Trade may approve."

The only means of communication provided, except, the Author believes, on the South Eastern Railway, was a cord running over the doors outside the carriages on the right side of the direction taken by the train. This, when pulled, worked a cam-wheel in the guard's van, causing a bell to ring, also opened a whistle on the engine. This method of communication was introduced by Mr. T. E. Harrison on the North-Eastern Railway, and was conditionally approved by the Board of Trade on February 27th, 1869, and officially sanctioned on August 1st, 1869. It was often found insufficient, and many accidents, especially derailments, were aggravated owing to the need of a proper means of communication. One reason for failure was that it was necessary to allow a slack in the cord to provide for the carriages going round curves and consequently unless the passenger pulled in sufficient slack no alarm would be raised. Eventually the sanction was withdrawn by the Board of Trade on January 1st, 1873.

How this came about is best described in Capt.

Tyler's own words to the Royal Commission of 1874. He observed, "The companies came to Mr. Bright and said, 'We have got what we think is the best system, will you approve of it? We think the cord system is the best system, will you approve of it?' And Mr. Bright did provisionally approve of it, in opposition to the views of myself and my colleagues, and the result has been a failure. Mr. Bright could hardly do otherwise when the officers of the companies said it was a good system, than provisionally approve of it."

The cord communication remained, however, the principal means employed until all the companies agreed in 1899 to adopt the present system, whereby the pulling of a chain inside the compartment on either side opens the air pipe and causes a gradual application of the continuous brake, and thus attracts the attention of the trainmen.

This system, which was first tried on the Great Central R., was provisionally sanctioned by the Board of Trade in 1890, and fully approved in 1893. In May, 1897, the Board of Trade appointed a departmental committee to go into the matter under the chairmanship of Sir Thomas Blomefield, and as a result of their report, the Board of Trade in July, 1898, issued a circular to the railways condemning the cord system, and asking what the companies were doing in the matter. To this the larger companies replied—in the summer of 1899—that

they had adopted the brake communication.

It stands to reason that the want of punctuality was a frequent cause for disaster in former days, but now that the block system is employed throughout, that cause is entirely eliminated. Mr. Cardwell's Committee referred to it as the chief cause of railway accidents; the Royal Commission of 1865 alluded to it "as a great element both of inconvenience and danger." The Royal Commission of 1874 said that whilst on the evidence that they had received it was impossible to accept the dictum of the Cardwell Committee, that "of all the causes which have led to accident, unpunctuality is the chief," on the other hand they were no less unable to endorse the opinion that it might be disregarded in their enquiry.

A remedy suggested by the Committee of 1858 was that victims of the want of punctuality should have a cheap and summary means for redress. This, it was thought, would compel the companies to keep better time with their trains. The Royal Commission of 1865 objected to this proposal, but the Commission of 1874 said, "We think that influences such as those which arise from competition and a desire to promote traffic may be relied upon to displace the objection taken to this proposal by the Royal Commission of 1865, namely, that it would involve a reduction of speed or an increase of fares. Moreover, it is by no means certain that the public would not be willing to purchase

punctuality on these terms. Nor is it clear that the objection is well founded in fact, for the fast trains are at present the most regular, and the principal causes of unpunctuality are such as could easily be removed if the matter were taken up by the companies. We may specify, for example, the encouragement of excursion traffic without making adequate arrangements for the conduct of it; the practice of attaching to engines more carriages than they are able to draw; general deficiency of locomotive power in trains, and want of discipline and method at stations. The only valid objection to the proposal seems to be that it might operate to promote the practice of making up lost time by running at a speed in excess of that fixed by the time-tables. This, however, would mainly apply to cases where time is lost at stations, and we think that companies might be trusted to deal with it. The change would, no doubt, lead to a more careful and frequent revision of time-tables, and, while lessening the risks of travelling, it would also remove one of the grievances of railway servants, for the unpunctuality of trains has an important influence on the labour of almost all classes employed in railway work, whose hours are disarranged and lengthened thereby." The Commission wound up by, as stated in the recapitulation of their report (p. 28), recommending that additional facilities be afforded to the public to obtain redress by cheap and summary process when trains are late.

As unpunctuality is no longer a cause of accidents, this subject need not be further noticed by the Author, but he may state that every effort is now made by railway companies to work their trains to their schedule, and when trains regularly lose time the officers do not hesitate to alter the time-table in order to give more time and ensure punctuality. At holiday times, when trains have to run in duplicate, these are all determined beforehand, in anticipation, and judged by the experience of previous similar holidays as to the amount of traffic, and times are laid down in the "special train programme." As far as possible, all special trains are worked to a schedule of which all signalmen and trainmen interested are advised. For certain trains that run irregularly—such as American specials—the time to be occupied in running between certain points is laid down, and signalmen when advised that such a train is running, and the hour at which it left the departure point, know approximately as to what time to expect it. For instance, in Table VI. is given, from Major Pringle's report on the Salisbury accident, the times of the L. & South-Western American specials from Plymouth. All regular goods and mineral trains are worked to a programme, and on some lines, e.g., the Great Western, certain columns in the "working time-table" are filled with times in which "a road" is possible for any special trains that may have to be run.

TABLE VI.

	Arrive	Pass	Depart
Devonport			0.00
Tavistock		0.20	
Meldon Junction		0.40	
Coleford Junction... ...		0.58	
Cowley Junction		1. 8	
Exeter, St. Davids ...		1.11	
,, Queen Street ...		1.14	
Sidmouth Junction ...		1.27½	
Seaton Junction		1.41	
Yeovil Junction		2. 9	Pass at 20 miles per hour
Templecombe	2.22		2.25 Stop at *Up* home signal & change engines
Dinton		2.45	
Wilton		2.50½	
Salisbury, West Box ...		2.54	Pass Salisbury at 30 miles per hour
,, East ,, ...		2.55	
Andover Junction ...		3.13	
Basingstoke		3.32	
Pirbright Junction ...		3.49	
Woking		3.54	
Hampton Court Junction		4. 4	
Wimbledon		4.10	
Clapham Junction ...		4.14	Pass at 40 miles per hour
Waterloo	4.20		

Train reports are sent by telegraph or telephone from certain points to the signal boxes in advance of it so that the men may know how the passenger trains are running, and regulate other passenger and the goods trains and shunting and other movements accordingly.

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CHAPTER VI.

The Block System.

The best way of showing how the number of railway accidents 30 or 35 years ago might have been reduced by the adoption of the block-system will probably be met by showing what the block-system attains.

In the terms of the Requirements of the Board of Trade in regard to the opening of Railways, it is the means of providing "an adequate interval of space between following trains and in the case of junctions, between converging or crossing trains."

When originally designed, it was the practice for the station at the entering end of the section to inquire from the leaving end, before admitting a second train, whether the first had arrived. This has gradually gone further, but even the use of these simple rudiments of the system might have avoided many collisions.

The block system now covers every sort of movement. Bell instruments are provided for sending the signals, and dial instruments for indicating by the position of needles, are generally employed for showing the state of the section. These show *line closed; line clear,* and *train-on-line,* and the needles are

deflected by the man at the far end whose own instrument shows him what indication he has given. These instruments are fully described in the Author's *Power Railway Signalling*.

Ordinary Working. The movements of a train between two signal boxes, say between B and C are as follows:— When a train is approaching B—generally when leaving A—the signalman at B calls up C by giving one ring on his bell, to which C replies by one beat on his bell. B then asks *Is line clear?* by giving the prescribed number of beats according to the class of train. If C can accept the train, i.e., he has nothing standing on the line, or about to perform any shunting, he acknowledges the signal by repeating it, and turns his needle—therefore the needle at B—to *line clear*. The signalman at B may then lower his outdoor signals, and when the train passes him he gives two beats on his bell to C, which the latter will acknowledge, and turn the needles to *train-on-line*. On the arrival of the train at C, the signalman there gives three beats on his bell and turns the needle to its normal position—*line closed*.

The above is for ordinary working, but junctions need special treatment. Imagine a line from A. to C. and a junction at B. for a line to D. It would be unsafe for the signalman at B after he has "accepted" a train from C to accept one from D or there might be danger in

their approaching the converging point simultaneously. *Junction working,* therefore, forbids the acceptance of trains from C and D at the same time. If one has been accepted, say from C, then the other must be refused and kept back at D. Further safety is provided in that before a train is accepted to proceed from A to D, the signalman at B must set his facing points *d* so that they lie towards D. It is a regulation of the block-system—both for ordinary and junction working—that after a train has been accepted, the position of no points must be altered.

There are many places in the Kingdom where it is difficult to enforce absolute junction working. In many cases the keeping back of a train at the box in the rear means delay to the train, or its acceptance may mean delay to the train on the converging line. This has led to the provision of intermediate signal-boxes, but where these are impracticable, or the expense was not justified and yet it was undesirable to keep the trains back, the case was met by the use of the *section clear but station or junction blocked* signal, commonly known as the "warning arrangement."

Mr. G. P. Neele informs the Author that this was introduced on the London and North-Western Railway in 1874.

By its use, converging trains are allowed to approach a junction simultaneously, providing that the signalman at the junction signal box has

sent the *section clear but station or junction blocked* block signal to the box in the rear for one of them. The man at the rear box then keeps his home signal at danger for the train, and having pulled it up he verbally instructs the driver that the line is clear to the next home signal, but that the station or junction is blocked. A green flag by day or a green light by night held steadily in the hand, must at the same time be exhibited to the driver and the home signal lowered.

This block signal was very popular, but a collision at Derby Junction, Birmingham, where the Midland line joins the L. & North-Western, in May, 1892, and one at Esholt Junction on the Midland Railway in June, 1892, where this signal had been used, led the Board of Trade to protest against such a general use, and as a result the "warning arrangement" is only now used in those instances where it is considered absolutely necessary.

Protection for trains shunting is afforded by the block system. Before a train may leave a siding or subsidiary line and foul a main line, the signalman must give what is known as the blocking-back signal, whereby the signalman at the rear is warned that the line at the next box is about to be occupied. This is done by a prescribed number of beats on the bell, and the deflection of the needle to *train on line*. Similarly, when trains are crossed from one main line to the other. In that case, the blocking-back signal is set for the line that is to be fouled.

The Norton Fitzwarren accident of November, 1891, may be remembered. In this case a goods train was shunted from the down to the up line, and then being momentarily forgotten by the signalman he accepted an up special passenger train, for which he lowered his signals, and a disastrous collision ensued. This led to no end of schemes being devised so as to guard against shunted trains being so overlooked, and some of the arrangements of special interlocking are noticed in the Author's *Mechanical Railway Signalling*. This accident also led to the introduction of an additional "recommendation" in the Requirements of the Board of Trade in regard to the Opening of Railways, to the following effect:—"Refuge sidings should be provided at all main line stations where slow trains are liable to be shunted for fast trains to pass them. If at such stations it is impossible to provide refuge sidings and slow trains have to be shunted from one main line to the other to allow of fast trains passing them, some simple arrangements should be supplied in the signal-cabins to help to remind the signalman of the shunted train." This "recommendation" has, however, been omitted from the list of requirements now in force. This is, no doubt, due to the fact that the blocking-back rule has been incorporated in the standard block signalling rules in force on all British railways.

The block system also provides for other contingencies which have led to a reduction in the

number of collisions. It may be generally known that in order that signalmen may know that a train is complete the last vehicle carries a tail-lamp. If then a train passes a signal-box with the tail-lamp missing or its light out, the signalman sends a bell-signal to the box in advance, and to the one in the rear, and steps are then taken to see that nothing has become detached.

Where a train passes a box and the signalman sees something amiss with the train, or a passenger giving signals of alarm, he can have the train pulled up at the next box by sending the "stop-and-examine" signal.

The block system also provides for vehicles that have parted from their train, and are running away either forward or backward.

As long, then, as the entrance of trains into a section are sanctioned by the man in advance, and as long as the man in advance does not improperly sanction the approach of a train, and, of course, as long as enginemen obey the fixed signals, collisions cannot occur. That the block system has had a good effect on the safety of railways is proved by the reduction in the number of collisions shown in Table II. (p. 38).

It has already been said (p. 16) that one of the members of the Royal Commission of 1874 was Mr. T. E. Harrison. This gentleman was a very able engineer, and he did more, probably, than any other British railway officer, to get the Westinghouse brake intro-

duced here. He, however, along with many other prominent men of that day, did not receive with enthusiasm some of the proposals for securing greater safety, and it is interesting to hear what he said in his addendum to the report as to the block system. He observed :—

In paragraph 36 it is remarked, with reference to the block system, " but the force of this objection depends upon the assumption that drivers working under this system have an increased sense of security and thus it becomes indirectly a testimony in its favour," a conclusion in which I do not agree. The absolute block system is held in theory to secure absolute safety, and the prevalence of this theory has undoubtedly created a new source of danger, it produces a feeling of false security in the minds of engine-drivers, officials and other servants, and, consequently, when emergency arises, they are not so well prepared as they would have been under the old system, and I feel satisfied that the natural consequence will be that engine-drivers of the future, brought up under the block system, will not be so careful and efficient as those who have been accustomed to look out for themselves. I am not prepared to give my unqualified approval to the block system as at present arranged and worked, for it is a well-established fact that collisions, with very few exceptions, take place at stations, junctions or relief sidings at block cabins; and if attention had been more directed to the most efficient protection of stations and junctions (leaving the intermediate portions of the line free from the block system, except in fogs and under extraordinary circumstances) than to the introduction, irrespective of differences of circumstances of a uniform arrangement based on a specific theory, much practical advantage would have arisen.

This is what Capt. Tyler said *à propos* of human fallibility in his annual report for 1872, and which deals with some of the points raised by Mr. Harrison.

Whatever be the amount of care taken, the item of human fallibility will always remain, and will always be the cause of a certain number of accidents. But the number of accidents from even this cause may be very much reduced by improvements in regulation and discipline, by greater care in the selection, training, payment and employment of competent men in sufficient numbers, and for reasonable hours, and by providing them with the requisite siding and other accommodation, with proper signal and point apparatus, with the best means for securing intervals between trains, with sufficient brake-power and with other necessary appliances. It is a favourite argument with those who oppose the introduction of some of these improvements, or who make excuses for the want of them, that their servants are apt to become more careless in the use of them, in consequence of the extra security which they are believed to afford, and it is desirable to consider seriously how much of truth there is in the assertion. There may, no doubt, be a tendency some times on the part of engine-drivers who are working under a block system to consider that the line is certain to be clear of trains ahead of them, and not therefore to keep so good a lookout between the signal cabins or with those who are working with an ample supply of brake-power to run with greater confidence, and to leave less margin for pulling up their trains, under the knowledge that they can, when necessary, bring their trains to a stand within a comparatively short distance. The guards and brakesmen, also under similar circumstances, do not see, naturally, the same necessity for running back to

warn following trains in the event of an unusual stoppage, when they are working under the protection of the block system as when they are aware that safety depends on their unaided exertions; and there may, no doubt, be a further tendency for the servants to run at higher speed and for the officers to encourage or permit higher speed, through facing points, and through places at which greater risk is incurred, in consequence of the greater security that is afforded by locking apparatus and locking-bars. In order to counteract these tendencies on the part of servants, stricter discipline is required, and it should be remembered that the block system is not intended to supersede the use of signals, or to obviate the necessity for exceptional protection in cases of unusual stoppage; that locking apparatus is not intended to obviate the necessity for reasonable precaution as to speed at places which are still less safe than portions of the line where there are no points or crossings or sharp curves, and that a safer margin should still be allowed for pulling up trains in proportion to the brake-power provided. But, making the most of these tendencies to confide too much in additional means of safety, the risk is proved by experience to be incomparably greater without them than with them, and, in fact, the negligence or mistakes of servants is found to occur most frequently, and with the most serious results, not when the men are over-confident in their appliances or apparatus, but when, in the absence of them, they are habituated to risk in the conduct of the traffic. In the daily practice of railway working, the trains must run as nearly in accordance with the time-tables as circumstances will permit; shunting must be got through with or without suitable accommodation; and station-masters, porters, signalmen, engine-drivers, or guards are frequently placed in difficulties which they have to surmount as best they can. The

more they are accustomed to incur risk in order to carry on their business the less they think of it, and the more difficult it is to enforce discipline and obedience to regulations. The personal risk which is encountered by certain classes of railway servants, in regard to which I shall say a few words presently, has never yet been precisely ascertained, but it is, as shown by the proportionate number of casualties, very great, and it is difficult, under any circumstances, to prevent men who are in constant danger themselves from doing things which are a source of danger to others, or, at all events, from disobeying regulations for which they do not see altogether the necessity, and which impede them in their work. The difficulty is increased with, and in proportion to, the want of necessary means and appliances, and is diminished when, with proper means and appliances, stricter discipline becomes possible, safer modes of working become habitual and a higher margin of safety is constantly preserved, Station-masters, porters and yardmen, working constantly under-handed, without sufficient siding accommodation, with defective signal and point arrangements, and without the proper use of the telegraph are, so to speak, trained to be reckless, and are almost obliged to carry on their work habitually in a way that would not be contemplated, and would be inexcusable under better arrangements. The most fatal accident of the past year was that at Kirtlebridge, in which 10 passengers were killed, and it was occasioned by the mistake of a zealous and hard-working station-master who, labouring under the disadvantages above referred to, himself turned a goods train into the way of an approaching express passenger train, but who ought not to have been under any obligation to work the points at all, and who could not, if the crossover road points had been interlocked with the signals, have committed such a frightful blunder. The accident ranking next to it in the

number of deaths was that in which four passengers were killed, at the Agecroft Sidings on the Lancashire and Yorkshire Railway. A signalman, forgetting in that case that an express train was due, allowed a coal train to leave the sidings as it was approaching. The new signal arrangements, with locking apparatus and telegraph instruments, by which such an accident would have been prevented, were being supplied, but had not been completed.

CHAPTER VII.

Interlocking of Points and Signals.

What is meant by the interlocking of points and signals will be best understood by extracts from the requirements of the Board of Trade on the subject:—

The levers by which points and signals are worked to be interlocked, and, as a rule, brought close together, into the position most convenient for the person working them in a signal-box or on a properly constructed stage.

The interlocking to be so arranged that the signalman shall be unable to lower a signal for the approach of a train until after he has set the points in the proper position for it to pass; that it shall not be possible for him to exhibit at the same moment any two signals that can lead to a collision between two trains; and that, after having lowered the signals to allow a train to pass, he shall not be able to move any points connected with, or leading to, the line on which the train is moving. Points also, if possible, to be so interlocked as to avoid the risk of a collision.

Safety points to be provided upon goods and mineral lines and sidings, at their junctions with passenger lines, with the points closed against the passenger lines and interlocked with the signals.

The figures given in Chap. IV. show that in 1875 there were 10,876 cases where the points and signals were not concentrated, i.e., "the

levers by which points and signals are worked to be . . . . brought together." The running signals were often worked by "turnover" levers on the station platform, and the points by loose levers at the points themselves. On single lines, the points giving access to the loops and crossing places at stations, were loose and provided with an indicator to show whether they were lying in their correct position.

There were also 13,275 cases where the signal and point levers had not been interlocked. This, of course, included the 10,876 cases of non-concentration, and the remainder would be where the signal levers were not interlocked with point levers or with each other, and *vice versa*. By this means it was possible for signals to be lowered when the road was fouled by points being opened that should be closed.

Then there were 7,041 cases where safety points had not been provided in goods lines and sidings. These are what are known in America as "derails," and were placed in the siding or goods line at the fouling point of their junction with a passenger line so that should any train attempt to leave against the signals it would be derailed. The interlocking in this case is that the derail must be closed, i.e., lever over, before a signal can be lowered for a train to leave, or set back into, the siding.

One of the worst accidents of the early seventies due to the absence of interlocking, occurred in October, 1872, at Kirtlebridge, on the Cale-

donian R., when ten passengers were killed, and which was referred to in the quotation from Capt. Tyler's report given at the end of the last chapter. Here was a junction between the Caledonian main line and the Solway Junction R. The points of the junction were worked from an elevated signal-box and protected by home and distant signals, but the points of the various siding connections and crossover roads were worked from the ground, and were not controlled by the signal-box nor interlocked with the signals. On the morning of the accident a goods train was doing some shunting on the up line, and as some wagons were being set back along that road, the station-master, assuming that they required to pass on to the down line, opened the points of the cross-over road so that the wagons went through just as the 9.0 p.m. Scotch express from Euston was approaching.

There is no need to here point out how interlocking would have prevented such a collision, but in order to appreciate the situation of those days it is desirable to quote the following from Capt. Tyler's report on this accident :—

In the working of railway traffic of this character, on a railway on which fast non-stopping trains run daily and nightly through stations at which goods trains are shunted, it is essential to safety that two systems should be applied —(1) The locking system,—(2) The block system. These two systems have formed the staple recommendations of the officers of the Board of Trade in their reports on

collisions for many years past; there has been so much misunderstanding in regard to them, not only on the part of the public, but also by officers of railway companies, that I will take this opportunity of making a few remarks in regard to them. They are distinct systems, having separate objects, but they should be jointly applied. The block-system is a means of securing space-intervals, in place of time-intervals, between trains following one another on the same line of rails, and it may also be applied to prevent trains from approaching junctions from different directions at the same moment. The locking system is a means for preventing mistakes by signalmen or others, in lowering signals when points are in the wrong direction, or in altering points when signals are lowered, or in making conflicting signals, so as to endanger the traffic. The signals and points are not, indeed, worked together. When all the signals are at danger the points are free to be worked. But the levers are so interlocked that they require to be worked each in its proper order, according to the line to be used or the work to be performed. Under an efficient block system, trains may follow on a line of rails at intervals of a few minutes, almost without risk. Under an efficient locking system they may pass through complicated junctions, and cross the directions of each other in and out of complicated stations, at intervals of a few seconds, with a surprising degree of safety. They neither of them cause obstructions nor delay in the working of traffic, unless from the want of cabins nearer to one another, or of extra siding accommodation. On the contrary, they admit—the block-system of trains following more closely upon one another,—the locking system of trains being turned one after another in different directions more rapidly; and, in fact, the more constant the traffic, the more these systems become necessary, not only to its safe working, but also to the avoid-

ance of delay. When delays do occur, it is a proof that better arrangement or extra accommodation is required. On the Metropolitan and North London Railways the traffic could not, probably, be carried on for a single day without accident if it were not for the protection afforded by the block-system. At the Cannon Street station the traffic could not be worked at all during busy periods of the day if it were not for the protection and confidence afforded to the signalmen by the locking system. In this particular case at Kirtlebridge, the accident would have been rendered impossible by the locking system alone, and without the block system; and the station-master was obliged to perform duties of working points which ought to be performed by a signalman protected by locking apparatus. It is essential to the succesful working of the block system that the signalmen in the block-telegraph cabins should be provided with the means of controlling the traffic. For this purpose they must work the siding points, safety points, crossover-road-points, and junction points, as well as their signals; and the levers for working the points and signals in different directions must be interlocked with one another. During the year 1870, out of 122 train accidents, there were 60 cases of defective signal and point arrangements and want of interlocking, and 43 cases of the want of telegraph communication or of a good block system; and during the year 1871, out of 159 train accidents there were 53 cases of defective signal and point arrangements, and want of interlocking, and 32 cases of want of telegraph communication or of a good block system. I need not repeat here all that I have said on these subjects in my annual report on Railway Accidents for 1870, issued last year, and in that for 1871, which is now ready for issue; but I append to this report a detailed summary of the more im-

portant accidents that have happened on different railways during the last few years from the want of proper signal and point arrangements and of locking apparatus. It will be observed that those 27 accidents have occasioned the death of 18 and injury to 403 passengers and servants of companies; and I submit that I did not go too far when I said, in my annual Report on Railways lately issued as an Appendix to the Report of the Joint Amalgamation Committee of the past session:—

"The records of the Board of Trade for many years point strongly and continuously to the difficulty that has existed in inducing, especially the larger and more powerful, companies to adopt improved systems of working and principles of construction even after they had been thoroughly tested by actual practice and introduced into every-day work, and when they were of the most obvious character. Very much is still wanting in these directions for the conduct of the traffic and the safety of the passengers. The most extensive railway systems have, in many respects, been far from keeping pace from time to time, with their constantly growing business and corresponding requirements; and how much they have fallen behind in providing appliances necessary to safety may be partially understood from a perusal of the General Report on Accidents above referred to."

In looking through the reports of the Board of Trade on railway accidents during 1872, the Author came across some interesting cases. For instance, on June 24th, a collision occurred at Blue Pits (now Castleton) North Junction. The home signal at the North Junction was controlled from the South Junction box, and although the line was clear from the North to the South box, yet because the man at the latter

box could not let the train go forward he did not take off his slot on the North Junction home signal for a passenger train, which was therefore brought to a stand. A coal train was following the passenger train, so the signalman at the North box "set his road" and endeavoured to get the driver to pass the home signal by showing a green flag, but as the man would not move, and the driver of the coal train was unprepared for the obstruction, a collision occurred. Colonel Yolland inquired into this accident, and he said in his report:—

The Company's officers blame the driver of the passenger train for obeying the danger signal and stopping at the North Junction and for not drawing past it when the green flag was waved by the signalman; and they also complain that the signal at the North Junction is controlled by the South Junction signalman, and urge that the old system of a distinct distant signal, worked from the South Junction, is to be preferred to the present system. They admit, and it cannot be questioned, that the collision was directly due to the driver of the coal train not pulling up under the distant signal short of the point of obstruction. But it has been repeatedly stated to the Inspecting Officers of the Board of Trade that the exigencies of the traffic are so great on the Lancashire and Yorkshire Railway, that it is impossible to keep the interval of time between following trains prescribed by the Company's regulations; and, although this fact has been known for very many years, and the Inspecting Officers have, in consequence, constantly been urging the introduction of the absolute block system for working the traffic, very little has been done in this respect on this important line of railway,

where it is probably more required than on any other. The collision could not have occurred if it had been in operation on this part of their line.

Colonel Rich, in reporting on a collision at Seaforth on the same line due to a light engine running into a passenger train, causing several passengers to be shaken, said: "The collision was caused by the gross carelessness of the driver of the light engine. The Lancashire and Yorkshire Railway Co. have very properly dismissed him, and proceeded against him. I did not see the man as he is now on bail to stand his trial for his offence."

An incident that clearly shows the attitude of the late Sir Richard Moon towards the Board of Trade is revealed in a report by Capt. Tyler on a collision that occurred at Coventry on the London & North-Western R. He concludes the report by observing:—

It is very surprising that a great company like the London and North-Western Company should, after all the warnings which they have received, have neglected to add safety points at the end of such sidings, and especially when their attention has been so constantly drawn to the necessity for providing such safety points. I would take this opportunity of recommending strongly that the directors of this company should call for a report upon all parts of their system; that they should thus ascertain distinctly what proportion of it is now in a dangerous condition from a similar want of proper appliances; that the question should be thoroughly considered as a whole, with a view to a scheme for general improvement; and that no

unnecessary delay should occur in placing their system in a proper condition in these respects; and I am the more induced to do so in consequence of the following remarks which were made by the Chairman of the Company at the last half-yearly meeting of the shareholders:—"He believed that the Board of Trade were as responsible for railway accidents as the companies were. It was a divided management with all the responsibility on one side only. The Board of Trade insisted on signals and other works, which involved a large expenditure on the companies."

Colonel Rich continues:—

The story of the above accident is a suitable commentary upon these observations. The passenger lines of the company near the site of it have been left for a series of years without any means of protection either by a stationary signalman, or by safety-points, or even by the use of chock-blocks. Imminent risk of a most serious accident has been continually incurred. Is the Board of Trade responsible on the one hand, for such an accident occurring from the want of apparatus which it constantly recommends the company to adopt? Is not the Board of Trade justified, on the other hand, in insisting as far as it has the power to do so, on the application of appliances necessary for safety, even though they "involve a large expenditure on the companies"?

On the other hand, this is what Colonel Rich had to say about the Midland Co.:—

I am informed, and have been requested by the Midland Railway Company to add, that they are doing a great deal at the present time towards applying the best-known means for the safe work-

ing of their line. Out of 900 miles of railway of which the Midland system consists, 450 are at present worked on the absolute block-telegraph system, and the company are proceeding, as quickly as they possibly can, in applying the block system on the whole of their lines. They have also been incurring for some years past an annual expense of £40,000 in reforming the point and signal arrangements on the old portions of their line, in addition to what they are doing on the new portions. They are very properly devoting their attention to re-arranging the larger and more important stations on the main line in the first instance. Bardon Hill and stations of that class are to be done in their proper turn, as quickly as possible.

Then lastly there may be quoted a sentence in one of Colonel Yolland's reports. He said:—

> Altogether there were more people in fault respecting this collision than I have usually found when investigating accidents on the Great Western Railway.

One class of accident due to the absence of interlocking was the turning of trains into sidings or loops instead of their continuing on the main line. Such accidents would arise from the facing points not being "set" for the main line, and there being no interlocked signals which would otherwise have indicated that the line was not properly "made" as the main line signal could not be lowered if the facing points were lying for the siding. During the four years 1872-3-4-5 there were 112 such accidents in which seven passengers were killed

and 413 injured, and 5 servants were killed and 43 injured. During the same period, there were 58 collisions (causing 7 deaths and 488 cases of injury) between engines and trains following one another on the same line of rails excepting at junctions, stations, or sidings. There were 88 collisions at junctions, involving 13 deaths, and causing injury to 788 passengers and servants, and 331 collisions within fixed signals at stations or sidings. These latter caused the deaths of 47 passengers and 18 servants, and injury to 2,410 passengers and 215 servants.

It does not follow that all these were caused by the absence of interlocking, but a good proportion would be, and the majority of the remainder were due to the non-provision of the block system and of continuous brakes.

CHAPTER VIII.

Continuous Brakes.

The adoption of continuous brakes by railway companies has not only considerably reduced the number of railway accidents owing to the greater rapidity with which trains can be pulled up, but it has led to an acceleration of train service as steam need not now be turned off as early as in former days. Another advantage is that the separation of vehicles in a train equipped with a continuous brake automatically applies the brake so that should a train break loose the train-pipes are opened and the continuous brakes on both portions of the train applied.

Insufficient brake power was often a contributory cause for former railway accidents. The celebrated brake trials at Newark on the Midland R. in 1875 were carried out under the supervision of the Royal Commission of 1874, and they found that the amount of hand-brake power usually supplied with the trains of the respective companies failed to bring up a L. & North-Western train within 2,374 ft., that of the Caledonian Co. within 3,190 ft., that of the Midland

Co. within 3,250 ft., that of the G. Northern within 3,576 ft., and that of the Brighton Co. within 3,690 ft. The speed in each case amounted to from 45½ to 48½ miles per hour.

Whilst the Board of Trade officers foresaw the great benefits that would arise from the adoption of continuous brakes, they were careful not to commit themselves. For instance, Capt. Tyler in his annual report for 1874 said :—

> When a form of continuous brake can be decided upon, cheap in construction, simple in action, easily adjusted, not requiring frequent repair, not liable to get out of order, applied at the will of the engine-driver and available in each part in the event of a train becoming suddenly divided, and with those numerous other properties that a good brake ought to possess, then a further great step will have been made towards safety and efficiency in railway working. But it must be admitted that there are many considerations involved and many difficulties to be encountered, and it will be far better in the end that time should be afforded for fully discussing, testing and improving to the utmost the many systems of brake power advocated than by any premature and general adoption of what may afterwards be found to be an inferior system, to create more or less a bar to further improvement.

The experts who represented the Royal Commission at the Newark experiments recommended, as a result of the trial, that the railway companies should be expected to pull up a train travelling on level ground at a speed of 50 miles per hour with 95 per cent of the wheels

braked, in 275 yards, and the table for other speeds would be, on this basis, as follows :—

Speed of train, in miles, per hour.		Stopping distance, in yards.
60	...	400
55	...	340
50	...	275
45	...	220
40	...	180
35	...	135
30	...	100

Some engineers of that day objected to brakes being attached to the wheels on the engine. Sir (then Mr.) George Findlay in giving evidence before the Royal Commission, said :—

Our engineer, Mr. F. W. Webb, has a very decided objection to a powerful brake being applied to ordinary express passenger engines. He thinks that any sudden stoppage of the engine, especially the driving wheel, might result in damage or injury to the mechanical parts of the engine and probably might produce accidents from that cause.

Mr. Webb, in giving evidence, said that his fear was the breakage of the coupling rods, and that he preferred to reverse the engine. The brake trial experts therefore said :—

It is to be hoped that further experience will satisfy railway companies that there is no greater objection to the use of brakes on the engine wheels than to the action of putting them in reverse gear with back steam because our report shows that the brakes do more work towards stopping the train than the attempt to reverse the wheels, and as the engine forms so large a proportion of the weight of the train it is important to use it to the very best advantage for stopping purposes.

The Royal Commission said on this latter point:—

The controlling power in trains may be greatly increased by fitting brakes upon the engines; and this is of importance not only for the reasons just indicated, a valuable addition being thus made to the brake-power under the immediate control of the engine-driver, but also because the locomotive is the heaviest portion of the train. Although most of the companies have some engines so fitted and the practice appears to be adopted to a considerable extent in other countries, some difference of opinion exists on the question amongst locomotive engineers in England. We have not heard of any case where engines have been injured from the application of brakes, and if their constant use be deemed undesirable it can easily be avoided by regulations which will permit the driver to apply the brake only in exceptional circumstances.

The following further observations of the Royal Commission will be interesting in the light of subsequent events:—

It is desirable to notice in this connection that if the increased sense of security arising from the possession of adequate power, produces on the part of men in charge of trains a tendency to become lax in obeying signals or generally less vigilant, the improvement we advocate cannot fail to operate as a new element of danger. And, moreover, exceptional cases will probably occur in which the sudden application of powerful brakes will itself produce some risk of injury to passengers. But the counterbalancing advantages of increased brake power are so great that we think no considerations such as these ought to avail to depreciate the importance of our recommendation in this matter.

Mr. Farrer wrote the Railway Companies' Association on January 13th 1877, suggesting a committee to consider the question of brake power, especially for the general adoption of the most efficient form of brake power. On April 18th, 1877, Mr. Leeman, the chairman of the Association, replied that they cordially appreciated the considerate and practical suggestion, but that, as then advised, it did not appear essential that one form of brake should be universally adopted, but with a view to secure a general interchange of practical knowledge on the subject, the experience gained by the companies was freely communicated to each other from time to time. On May 18th, 1877, Mr. Oakley, as secretary to the Association, sent to the Board of Trade information as to what the companies had done in the matter up to then.

In August, 1877, Mr. Stanhope on behalf of the Board of Trade sent out his famous circular laying down the conditions which the Board of Trade considered any system of continuous brakes should comply with. These were (a) The brakes to be efficient in stopping trains, instantaneous in their action and capable of being applied without difficulty by engine-drivers or guards. (b) In case of accident to be instantaneously self-acting. (c) The brakes to be put on and taken off (with facility) on the engine and every vehicle of a train. (d) The brakes to be regularly used in daily working. (e) The materials employed to be of a durable

character so as to be easily maintained and kept in order.

In 1878 was passed the Railway Returns (Continuous Brakes) Act, 41 Vict. Ch. 20, which ordered the railway companies to send in bi-annual returns as to the progress made in the equipment of continuous brakes, the returns to contain such particulars and to be in the form specified in the schedule to the Act.

According to the first return presented to the House of Commons, there were at the end of June, 1878, 172 engines and 817 vehicles equipped with a brake that complied with the Board of Trade requirements, and 634 engines and 7,310 coaches with a brake that did not meet all the conditions.

In July, 1879, an unusual course was taken. Mr. T. E. Harrison, who, it will be remembered, was a member of the Royal Commission of Railway Accidents, had made a report to his directors (North-Eastern R.) on the Westinghouse brake and a copy of this report was printed and circulated by order of Parliament.

In 1889 automatic continuous brakes were ordered by the Railway Regulation Act—see Chap. XII.

CHAPTER IX.

Accidents on Single Lines.

The number of collisions on single lines of railway, at all events on British roads, has been remarkably small and proves the truth of the adage that the greater the danger the greater the safety.

There were, however, two very serious collisions about the time that the Royal Commission was sitting. One was the terrible accident near to Norwich, Thorpe, in September, 1874. In this case the 5.0 p.m. from Liverpool Street met the 8.40 p.m. mail from Yarmouth between Thorpe and Brundall, and 25 persons were killed. The schedule showed that the latter should wait at Brundall until the former had arrived, but this arrangement had to be modified when the down express was late. In such an event a telegram was sent from Norwich to Brundall couched somewhat as follows:—"Send up mail on to Norwich before the 9.10 p.m. down passenger leaves Norwich." This would be acknowledged by Brundall in a message something like this:—"I will send the up mail train on to Norwich before the 9.10 p.m. down passenger leaves Norwich." It was one of the requirements of this method of working single lines that no

train was allowed to enter on to a section without what was known as a "starting order." This was issued by the station-master or inspector who was responsible for the working of the section, and who was the person to give instructions for any telegrams to be sent changing the crossing orders. These messages had to be written down *in extenso* in a special book and signed by the station-master or inspector who had also to sign the message received in reply, and until he had done all this he was not to take any action changing the schedule.

On the night in question the down express was late, and the inspector went to the telegraph-office and told the clerk to have the mail sent on from Brundall. He did not stop to see the message written out nor did he return to sign it. The clerk wrote it out, and against the regulations sent it off before being signed, and as a result the mail left Brundall. The inspector admitted having given these verbal instructions, but says that immediately afterwards he saw the express at the ticket platform and that he then returned to the telegraph-office and cancelled the instructions. He then went on with his duties and allowed the express to depart, and it was not until the clerk happened to notice that the express was not in the station that he gave the alarm. The question of punctuality naturally arose over this accident, as if both trains had been "on time" there would have been no need for the schedule to be changed, and the

trains would have crossed at Brundall as in the time-table. From a return that appears in an appendix to Capt. Tyler's report the Author notices that for the whole of the year ending August 31st, 1874, the express only arrived at Norwich punctually on seven occasions and the mail only four times.

At that time many companies were using the train-staff for working their single lines. This was a method first employed on the L. & North-Western R. near to Leamington, whereby each section had a staff or symbol without which no train might enter on to a section. The possibility of trains meeting was therefore removed, but there were great delays, as when a train arrived at one end when the staff was at the other it could not leave until the staff arrived. Some relief was experienced by the adoption of tickets which were kept in a box of which the staff had the key. One of these tickets was handed to a driver when two or more trains were going in the same direction. The staff was then taken by the last train of the batch. This method of working was, however, unsafe unless the block-system was simultaneously employed, as following trains had to be protected against one another.

As explained in the Author's *Power Railway Signalling*, the system of train-staff and tickets has now been much improved by the introduction of the Electrical Tablet and Electrical Train Staff systems.

The other serious collision occurred at Radstock on the Somerset and Dorset Joint line in August, 1876. Two trains met, causing the death of 12 passengers and 1 servant and injury to 28 passengers and 6 servants. Crossing orders were here employed, but gross carelessness was revealed, also excessive hours of duty, the employment of youths in responsible positions and a great lack of discipline. The line had just been taken over jointly by the Midland and L. & South-Western Companies.

Further reference is made to this subject in Chap. XIX. dealing with American Railway Accidents.

CHAPTER X.

Long Hours of Duty. Intemperance.

The question of excessive hours of duty did not in those days—the early seventies—play the prominent part in the Board of Trade reports on railway accidents that it did in subsequent years. There were, however, some bad cases. For instance, an accident occurred on the Waterford & Limerick R., and the driver was subsequently dismissed for being drunk. Colonel Rich inquired into the accident, and he said: "On inquiring closely into this matter, I could not ascertain that the man had had any drink, or that he was suffering from the effects of it. I believe that he was thoroughly exhausted from being employed nearly 21 hours on continuous duty, and that he failed to observe the distant signal in consequence of the sleepy and exhausted state that he was in when he approached Carrick Station." In the Radstock collision on a single line, referred to on p. 87, the telegraph clerk at Wellow worked from 14 to 15 hours each day, and on the date of the collision he was on duty from 6.30 a.m. to 11 p.m. The station-master at the same station—who was committed for manslaughter—was found fault with by the company for being away

from the station, but, as Capt. Tyler remarked, "if he had remained at his work he would have been on duty from 5.30 a.m. to some time after the accident, say for upwards of 18 hours."

Mr. Galt in his addendum to the Report of the Royal Commission of 1874 said:—"During the course of our inquiry in different parts of the Kingdom we met with many cases in which railway servants were sometimes required, and in other cases, without any pressure being put upon them, were at work for a much greater number of hours than could reasonably be expected that they would be in a fit condition to work; as a general rule such cases were exceptional, and the men generally were satisfied that their hours of labour were not excessive."

The Author will not deal further with this subject as there is much to say thereon in connection with more recent events, and this is further noticed in Chap. XX.

In the matter of intemperance as a contributory cause of railway accidents, there is much cause for regret when the records of former years are studied, but when we come to the present day we find reason for great satisfaction. Mr. Allport, when giving evidence before the Royal Commission, said that in 1857 instructions were given to the tenants of the refreshment rooms on the Midland R. not to supply employees with intoxicating liquor, and that tea and coffee were supplied to the company's servants at a lower rate. Mr. Grierson said the

same as to the Great Western, and added that in the year ending January 31st, 1875, there were 30 men connected with passenger trains, 9 with goods trains, 2 drivers and 4 firemen dismissed for drunkenness.

In their report the Royal Commission said:—

It appears from the railway companies' records of men dismissed for drunkenness and of fines and cautions imposed for this cause, that the annual number of such cases is considerable. At the same time we are satisfied that railway servants as a class are remarkable for sobriety, and we have no doubt that in many instances they exceed through yielding to the temptations to which they are subjected by passengers supplying them with drink or treating them in the refreshment rooms. This is a matter upon which it is difficult to obtain accurate information, but the answers we received in evidence convince us that the practice exists and we believe it to be a great evil and one that ought to be promptly checked. Inquiries we have instituted lead us to suppose that, in many cases, railway companies provide refreshment rooms as a means of profit rather than to meet the requirements of their passengers, and the increase of such rooms at stations is deplored by many of the railway officials. But it would be beyond our province to enter on any general discussion of this question, and we confine ourselves to urging upon companies the great importance, increased in proportion as they afford facilities for obtaining drink, of adopting adequate means to save their servants from the dangers to which they are thus exposed. The matter is one which affects the companies themselves still more immediately even than it concerns the public, and the companies alone are competent to deal with it. Among the general regulations

recommended to all the railway companies for adoption . . . . we find the following, "No guard, engine-driver, fireman, signalman, policeman, porter or other servant of the company while on duty is allowed to enter a station refreshment room except by permission of the station-master or person in charge of the station." The effect of this would be to place railway servants under restrictions as to obtaining drink similar to those imposed upon constables on duty. If proper accommodation were provided at the principal stations to enable the servants to obtain suitable refreshments apart from the passengers and a regulation such as has been quoted were strictly enforced, the evils we have alluded to would be greatly reduced. We recommend the matter to the earnest attention of the companies, and if they should find it necessary to the enforcement of discipline in this respect to seek powers to make the tenants of the refreshment rooms liable to a penalty for supplying drink to servants in violation of the regulations, we recommend that the Licensing Acts should be amended accordingly.

Since this report was issued much has happened. The nation is more sober and in no path of life is it more so than in the railway service. Cases where, in reporting on railway accidents, it is suggested that men were under the influence of drink, are most rare. Much of this better state of affairs is due to the natural trend of the people towards more temperate lives, but on the railway, as in the army and navy, much has been done by Temperance Societies which have received the strong support and financial assistance of directors and officers. On the leading English lines there are branches

of the United Kingdom Railway Temperance Union. These branches have 300 centres and 37,947 members. They are undenominational and non-political, and have two classes. Class A is for temperate men but not abstainers, and Class B is for abstainers. The L. & North Western R. have made the greatest progress. In 1905 they had 4,777 members, in 1906 there were 11,193, in 1907 it had grown to 14,500, and now it is 17,536. The Great Western have 10,430 members, an increase of 1,837 since 1907, the North-Eastern 6,008, and the Midland have 5,073 members.

During the last two years there has been issued a beautifully got up circular to the members of the staff of the L. & N.W., Midland, and North-Eastern Companies. These have been supplied free of cost to the societies by the printers of the companies. In this way 190,000 circulars have been issued. It is likely that the Great Western and South-Western will follow suit which will mean another 120,000 circulars.

Another important fact to be noted was the meeting of the staff at Euston in February, 1908. It was held in the shareholders' room and presided over by Lord Stalbridge, the chairman of the company, supported by several directors and the chief officers.

CHAPTER XI.

The Armagh Railway Accident.

Coming now to more recent years we reach an event that had a great effect on the safety of British railways as it led to the Regulation of Railways Act of 1889 compelling the adoption of interlocking, the block system and automatic continuous brakes.

On June 12th, 1889, a heavily-laden excursion train of Sunday-school children and others, consisting of engine, tender and 15 vehicles, including a brake van in front and a brake carriage in the rear, fitted throughout with the non-automatic vacuum brake, from Armagh to Warrenpoint, failed to quite reach the top of the rising gradients of 1 in 82 and 1 in 75 which commence about .29 mile from the buffer stops at the end of the platform of the Newry and Armagh station at Armagh and extends for 3.15 miles. The train was then divided between the fifth and sixth vehicles from the engine to enable it to be taken on in two portions, but the rear 10 vehicles, having been inadequately secured, ran back towards Armagh, and met at a high rate of speed—about 1½ miles from the spot from which they had commenced to move backwards—the

ordinary passenger train from Armagh, which, had started about 20 minutes after the excursion train, and which was being stopped, although it was still running at a speed of probably five miles an hour when the collision took place.

The effects of the collision were most disastrous, the rear three vehicles of the excursion train being completely destroyed, their *debris* being thrown principally to the right of the direction in which they had been running, down the slope of an embankment about 46½ ft. high, on which the railway is here carried. On the collision occurring the engine of the ordinary train—which consisted of engine and tender, horse box, brake van, three carriages and third class brake van fitted with the non-automatic vacuum brake—was separated from its tender and thrown over to the right upon its right side (left wheels uppermost) on to the top of the slope of the embankment. The rear five vehicles broke away from the horse box, ran back down the incline and were stopped by the guard in the rear brake van applying his hand-brake after they had run back about a quarter of a mile. The tender and horse box also ran back and were stopped by the driver—who upon the crash occurring had turned round and was holding on by the tender coal plate—applying the tender hand-brake (which had remained in working order) a few carriage lengths short of the rear five vehicles. No less than 78 passengers were killed—of which 22 were 15 years of age and

under—and 260 passengers—of whom about one-third were 15 years old and under—were more or less severely injured. Two passengers in the ordinary train and the rear guard of the excursion were injured, the latter having a marvellous escape as he remained in the rear van when it ran back and was in the wreck.

There is no need now to explain what were the causes of the engine failing to reach the top of the bank; nor why, after the train was divided, the rear portion ran back. But it will be apparent to all at this time of day that an automatic and a continuous brake would have held the rear portion when the train was separated, also that the block system should have prevented the ordinary train leaving Armagh until the *train-out-of-section* signal had been received for the excursion train from the box in advance.

But before these points are noticed it should be observed that two of the rules in the standard book of rules were broken. These are "Rule 223:—When the train is stopped . . from any cause (except where it is efficiently protected by fixed signals) the guard, if there be only one, or the under-guard if there be more than one, must immediately go back 1,200 yards to stop any following train. . . The guard must not return until recalled by the engine-driver sounding his whistle." "Rule 226 (c):—Should a train come to a stand travelling up an incline, the driver must send his fireman to the guard to acquaint him with the cause of stoppage, and

the train must remain standing, and be secured in its position until a distinct understanding has been come to between the driver and the guard as to their further proceedings. With a heavy train . . . the guard must not leave his van until perfectly satisfied that his brake will hold the train securely. The train must not be moved again in either direction until the guard has resumed his van."

The Great Northern (of Ireland) Railway had equipped all their 90 engines and all (378) of their coaches with the simple vacuum continuous brake. This was not automatic in its action. Had it been so the brake would have remained on when the train was divided, or if it had been taken off it would have been applied. The rear vehicles would then have been immovable notwithstanding any possible bump they might have received from the front of the train when the engine was set back to get a start. An automatic brake would also have avoided the risk the ordinary train ran when it was divided, of the two portions coming into collision with each other or with the buffer stops.

The block system would not have saved the train from running away, but it would have kept the ordinary train back at Armagh, and there was the chance that the signalman at Armagh might have turned the runaway train on to a line that would have reduced its speed and modified the results, if not avoided any ill results at all.

A good deal of feeling was aroused throughout the country at this accident—the worst on record for Great Britain,—and one result was the passing of the Railway Regulation Bill of 1889.

CHAPTER XII.

The Regulations of Railway Act, 1889.

Mr. (now Sir) Francis Channing was the critic of railways in Parliament at the time of the Salisbury administration. In May, 1888, he moved a resolution as to the safety of railways and that the powers of the Board of Trade should be extended. Sir Michael Hicks-Beach, then President of the Board of Trade, in reply, showed that companies were voluntarily making progress as to the provision of the block system, the interlocking of points and signals, and the use of continuous brakes. Figures were quoted indicating that the record as to the safety of passengers was higher than it ever was. The right. hon. gentleman admitted that the returns as to employees might be better, but there was an improvement in these too. He agreed that some action might be taken as to overtime, and promised that he would ask Parliament to deal with the matters raised. Mr. Mundella, a former President, and who was responsible for the appointment of the sub-inspecting officers, congratulated Sir Michael Hicks-Beach on his speech.

On March 5th, 1889, Mr. Channing reminded the President of his promise to introduce legis-

lation, but Sir Michael Hicks-Beach said he was not ready. The Armagh accident occurred on June 12th, 1889, and on the 18th *idem*, the President, in reply to a question by Mr. Channing, said if General Hutchinson's report confirmed the suggestion made by the hon. member he would consider whether it would not be possible to deal with the subject during that session.

The Bill was introduced in the House of Commons and read a first time on July 15th, but as it included clauses for the compulsory adoption of a system of automatic couplers "as may for the time being be approved by the Board of Trade," and for the substitution of bridges or subways for level crossings, considerable opposition was aroused against the Bill especially by the owners of private wagons. As a result this Bill was withdrawn, and a new one without the coupling and level crossing clauses, was brought in on July 30th. Mr. Channing moved an amendment calling for some improved apparatus for coupling and uncoupling vehicles which should render it unnecessary for men to go between them. The amendment was withdrawn, but an amendment was accepted as to printing the fares on tickets, and the Bill read a third time in the Lower House on August 12th, passed the House of Lords on August 26th, and received the Royal assent on August 30th.

The Act, 52 & 53 Vict., Ch. 57, provided that the Board of Trade may from time to time order a railway company to do, within a time limited

by the order and subject to any exceptions or modifications allowed by the order, any of the following things: (a) To adopt the block system on all or any of their railways open for the public conveyance of passengers; (b) To provide for the interlocking of points and signals on or in connection with all or any of such railways; (c) To provide for and use on all their trains carrying passengers continuous brakes complying with the following requirements, namely:—(1) the brake must be instantaneous in action and capable of being applied by the engine-driver and guards; (2) The brake must be self-applying in the event of any failure in the continuity of its action; (3) The brake must be capable of being applied to every vehicle of the train whether carrying passengers or not; (4) The brake must be in regular use in daily working; (5) The materials of the brake must be of a durable character and easily maintained and kept in order. In making any order under this section the Board of Trade shall have regard to the nature and extent of the traffic on the railway and shall, before making any such order, hear any company or person whom the Board of Trade may consider entitled to be heard.

Section 2 sanctioned the enforcement of the order by the Railway and Canal Commission and Section 3 authorised the issue of debenture stock by railway companies to meet the expenses incurred under the Act on a certificate by the Board of Trade "and no other authority save

the certificate of the Board of Trade shall be requisite to authorise and validate the issues of such debentures or debenture stock."

The same Act enabled the Board of Trade to deal with the companies as to the long hours of duty of employees. Section 4 provided that every company shall make to the Board of Trade periodical returns as to the persons in the employment of the company whose duty involves the safety of trains and passengers, and who are employed for more than such number of hours at a time as may be from time to time named by the Board of Trade. The returns shall be delivered at such intervals and shall be in such form and contain such particulars as the Board of Trade from time to time direct.

The remainder of the Act refers to other matters than those of the safety of railways.

The Author has already drawn attention (p. 6) to the fact that up to 1889 the only piece of legislation appertaining to the safety of railways—over and above the satisfaction of the Board of Trade on the opening of new or altered railways—was the unsatisfactory clause in the Regulation of Railway Act of 1868 dealing with Passenger Communication. It will therefore be interesting to inquire as to how far the Act of 1889 was called for.

It was stated on p. 10 that in 1873 powers were given to the Board of Trade to obtain yearly from each railway company an "Interlocking Return" showing what progress had

been made in the concentration and interlocking of points and signals, the provision of safety points where sidings and goods lines joined passenger lines and of the block system. The return for the year ending December 31st, 1888 —the latest before the Act of 1889—now lies before the Author.

From this return it would appear that 93.5 per cent. of the points and signals on English and Welsh railways were interlocked, 82 per cent. of the Scotch and 59 per cent. of the Irish. The percentage on the larger English and Scotch lines were:—Great Eastern 89 (86 in 1887), Great Northern 92, Great Western 91, Lancashire & Yorkshire 100, L. & North-Western 97, L. & South-Western 99.5, L. & Brighton 100, L. Chatham & Dover 100, Manchester, Sheffield and Lincs. (now Great Central) 94, Midland 93, North-Eastern 100, South-Eastern 71, Caledonian 94, Glasgow & South-Western 94, North British 76. Of the Irish lines the Northern Counties had 92 per cent. interlocked, the Great Southern & Western 58.5, the Midland Great Western 77, whilst the Great Northern (of Ireland) on whose line the Armagh disaster occurred, and who were then paying 5⅜ per cent. per annum dividend, only 26 per cent. were interlocked. This was an increase though of 4 per cent. over the figures for 1887.

From the same return it appears that 97 per cent. of the English and Welsh lines had the

block system on their double lines. The Scotch had 99 per cent., and the Irish 31 per cent., of which the Northern Counties had 100 per cent., the Great Southern 24 per cent. (against 19 per cent. in 1887), the Midland Great Western 48 per cent., but the Great Northern had only 14 per cent. (18½ miles out of 137). The return does not give the percentage for single lines, but out of 4,348 miles of single line in England and Wales 3,900 or 90 per cent. had either the block system—or its equivalent—or only one engine in steam was allowed in a section. The corresponding figures for Scotland were 1,180 miles or 70 per cent. out of 1,627 miles. In Ireland there were 2,124 miles of single line of which 629 miles or 30 per cent. were protected. Out of the 381 miles possessed by the Great Northern of Ireland the block system was only in use on 4½ miles, and only one engine in steam was allowed on 14½ miles.

As to continuous brakes the returns for the half-year ending June 30th, 1889, it appears that 75 per cent. of the engines and 72 per cent. of the coaches in Great Britain complied with all the requirements of the Board of Trade. Twenty per cent. of the engines and 20 per cent. of the vehicles were equipped with a continuous brake, but one that did not comply fully with the requirements and 5 per cent. of the engines and 8 per cent. of the coaches were not provided with any continuous brake. In nearly every case the point in which the requirement was not met

by the 20 per cent. of the engines and coaches was where it specified that the brake should be self-applying in the event of any failure in the continuity of its action. This was where the Great Northern of Ireland was at fault, and which contributed to the Armagh disaster. It is only fair to say that other companies were, at all events in this respect, equally remiss. Amongst these was even the L. & North Western.

From these figures it will be seen that excepting the Irish railways, the greater part of the English, Welsh and Scotch lines were properly protected by interlocking and signalling. That being so the advantages and benefits of these must have been appreciated by the companies, who would, without doubt, subsequently equip all their lines voluntarily. The question of automatic brakes would also have been solved, as those companies, e.g., the L. & North-Western, Manchester, Sheffield and Lincolnshire, etc., who had the simple vcauum in use were converting it to the automatic vacuum. Then the number of accidents just then was very low—in fact in the year 1887 there were only 174 collisions and derailments, and in 1888 there were only 186 which have only been bettered by the 156 of 1892, the 124 of 1894, and the 167 of 1895. Of the accidents during 1888 there were 61 inquired into by the Board of Trade, and amongst the causes assigned for these by the inquiring officers there are mentioned :—

absence of interlocking in 5, long hours in 5, want of the block system in 4, want of automatic brakes in 5.

It is due to the Irish railways to say that whilst their lines were not so efficiently protected yet they had a great freedom from accident, as out of 220 collisions and derailments during 1886 there were 13 in Ireland, 13 out of 174 during 1887, and 16 out of 186 during 1888.

It may be further remarked that during the 6½ years ending June 1896 the absence of the block system only contributed to 4 accidents in the United Kingdom of those reported on by the Board of Trade, the absence of interlocking to 6, and of continuous brakes to 3.

CHAPTER XIII.

Uniform Signalling and Rules.

One of the causes that have contributed to a reduction in the number of accidents is that all the companies have gradually got into line as to their rules for working. They have also a universal block code and their fixed signals are fairly uniform.

The need for this has grown year by year as the use of running powers has increased, and there is every probability of this becoming more so as the relations between the companies grow closer. Then will arise the question as to uniform fixed signals. This, however, is not the place where the Author will deal with that subject.

According to Mr. G. P. Neele's *Reminiscences*, in April, 1862, a sub-committee of the Conference of Superintendents meeting at the Railway Clearing House was appointed to draw up rules and regulations for drivers and guards working over the lines of other companies. Apparently little was done by this committee, but the subject being revived in 1865 the General Managers' Conference appointed a new committee which was presided over by the late Mr. E. M. Needham of the Midland R. This

committee reported in June, 1867, and its recommended rules were adopted by the Railway Clearing House and they took the form of an Appendix to the existing rules. In this Appendix appeared, for the first time, diagrams of the different types of signals used on certain lines—the Great Western cross-bar, the Midland oblong disc, and L. & South-Western circular disc.

One of the rules that appeared in the original rule-books—again quoting from Mr. Neele—was one relating to the observance of distant signals. It read:—"When a train is stopping at a station, or when there is an obstruction thereat, the main (i.e. the stop signal) and auxiliary (i.e. the distant) signals must be at danger, and any coming train or engine must be brought to a stand at the auxiliary signal when the engineman must open his whistle and afterwards proceed with caution towards the station." It was found that drivers could not always stop at the distant signal owing to a bad view of the signal, insufficient brake power, or not far enough "out." The rule as to actually coming to a stand was also indifferently observed. As a consequence the Board of Trade when reporting on an accident where the non-observance of this rule figured, often referred to it as a want of discipline. The committee looked into this matter and as a result they brought forward a new rule which was adopted. It read:—"When a train is stopping at a station or when

there is an obstruction thereat, the main and distant signals must be at danger and the driver of any following train or engine must, when he sees a signal of danger exhibited at the distant signal post, immediately turn off steam and reduce the speed of his train so as to be able to stop at the distant signal, but if he sees the way is clear he must proceed slowly and cautiously within the distant signal, having such control of his train as to be able to stop short of any obstruction there may be between the distant post and the station."

This was considered such an improvement and further improvements being possible in rules, and uniformity being desirable amongst all the companies, the General Managers' Conference appointed, in November 1874, another committee to secure a standard book of rules and regulations. It may be that the appointment of the Royal Commission on Railway Accidents in June 1874 had something to do with this decision. At least that was the view adopted by one of the Commission—Mr. Galt—who in his supplementary report said :—

The strong feeling of alarm aroused throughout the country by the increased number of accidents in 1873, caused the appointment of this Commission in 1874, which no doubt had the effect of stimulating the principal companies to unwonted exertions in order to avoid the necessity of any legislative interference with their management; the result was that in November 1874 they appointed a Committee selected from the most experienced officers of the

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several companies to draw up a complete and concise system of rules, which should govern the working of all the railways in the country. How far this Committee has succeeded in its object, and merits the confidence of Parliament and the country by the manner in which it has executed the trust confided in it, is a matter of much importance and will, no doubt, obtain special consideration. All the members of the Commission agree in opinion that some legislative measure or measures are necessary for the better prevention of accidents, but they are also of opinion that the free action of the companies should not be interfered with further than the safety of the public and of the companies' servants renders absolutely necessary. The Commission recommend that a Special Tribunal be appointed to deal with the causes of railway accidents; the companies on the other hand have appointed a committee whose duty it is to adopt such measures in the management of traffic as to reduce as far as possible the number of preventable accidents and in all probability both propositions will be submitted to Parliament.

It may be freely admitted that if the companies have organised a controlling body that has shown itself capable to regulate the management of railways, likely to be so efficient in its working as fairly to ensure the safety of the travelling public and that of their own servants, it would, I have no doubt, be accepted by Parliament, by Government, and by public opinion, as the best means that could be devised for carrying out that important object. There is a great indisposition in this country to interfere with private enterprise, even when that enterprise is developed in the construction of what in one sense may be termed public works. Many abuses are with us tolerated, and many excesses overlooked, in order to avoid such interference; with the exception of the United States of America there is less interference, and less desire to inter-

fere with the management of works constructed by private enterprise, than in any other country in the world. It was, therefore, with great interest and with the hope that some practical means would be devised for effecting an efficient control over railway management in the way above intimated, that we learned a project of that nature would be submitted to our consideration by Mr. Oakley, the General Manager of the Great Northern, on the part of the companies.

Mr. Oakley appeared before the Commission on the 4th August, 1875, and stated in sufficient detail the means by which it was proposed to create a uniform system of traffic working throughout the kingdom. He stated that in the previous year the directorates of the principal English companies had come to the determination to appoint a committee to effect this object, and at a meeting of General Managers on the 3rd November (1874) a committee consisting of the superintendents of the principal lines in the country had been selected to draw up rules and regulations for the guidance of officers and men of the railway service, which should be generally applicable to the working of all lines; that each company would be furnished with a copy of the preliminary code, and then were to discuss amongst its own officers how far these rules were applicable to its own system; that ten of the large companies were parties to this arrangement, but none of the smaller companies as these generally concurred in any resolution the great companies determined on. He thought that statutory powers to enforce the regulations upon all companies would be necessary.

The several details of management arranged by the committee, Mr. Oakley stated, came under the following heads:—1st, general regulations; 2nd, signals; 3rd, station-masters and porters; 4th, signalmen, pointsmen, and gatemen; 5th, guards and brakesmen; 6th, engine-drivers and firemen;

7th, permanent-way men, platelayers, and others; 8th, single line working; 9th, block telegraph system; and 10th, single line working during obstruction. The information upon these several heads had, when collected, to be interchanged at the Clearing House. The committee since its formation had met six times, and the conferences extended each time over three days, discussing and arranging all matters of detail under their several heads. It had yet to be considered "whether it should be left for each company to provide for its own special difficulties through its working book, or by an addition to those general rules which they proposed as a standard."

The case may be stated thus: "It appears by the last returns of the Board of Trade that there are 91 working companies in England and Wales, 22 in Ireland, and 6 in Scotland, and that 10 of the principal English companies have by this committee drawn out a set of rules which they propose should be adopted by all the other companies, but which it is admitted cannot be of universal application, and therefore could not be enforced by statutory powers. None of the lesser 109 companies were consulted in drawing up these regulations, nor, indeed, was there any necessity, as it was intended that each company should have power to act independently and according to the recommendations of the committee or not as it might think proper. Our late President saw at once the absurdity of the scheme proposed by the committee as it stood, and to enable it fully to carry out a reform in the working arrangements of the companies, recommended in his draft report "that the hands of this committee should be strengthened by any statutory powers which the authorities of the Clearing House might find it desirable to obtain for that purpose."

But the companies themselves did not ask for the authority that would make the control of this committee effective. The members of the com-

mittee who have been appointed are the subordinate officers of the ten principal companies, and in the event of Parliament coming to the conclusion that some control over the companies is necessary, it may be questionable if the 60 or 70 lesser English companies, the 22 Irish companies, and the five Scotch companies—the representative of one Scotch company is a member of the committee—would prefer putting themselves under the control of a body in which they would be entirely unrepresented to that of an authority duly constituted by the legislature.

It is further to be observed that the duties of this committee do not extend beyond endeavouring to have uniformity in working arrangements; but it must be obvious that unless it obtain statutory powers the refusal of other companies to acknowledge its authority would deprive it in a great measure of the necessary means to carry out the intended reform in management. There is no reason to doubt either the good faith of the principal companies in appointing this committee, or the zeal and energy of its honorary secretary, Mr. Oakley, in promoting its object; but even for the limited object in view, without obtaining statutory powers, it would be impossible for the committee to exercise that control over the companies which would be necessary to ensure success. Before the companies, however, who have appointed this committee can claim such powers from Parliament they should in my opinion be bound to prove (1) that the companies generally are willing to recognise this authority, and (2) that this committee has since its appointment effected such reforms in the working arrangements of the companies as under the circumstances might be reasonably expected.

Assuming, however, for the present that it has done so, the duties of this committee fall very far short of the requirements necessary for public safety, as they are limited to working the traffic,

leaving all other causes of accidents specified in Captain Tyler's reports unprovided for; such as the defective construction and maintenance of permanent works and rolling stock, insufficient accomodation for the traffic, adoption of the block and interlocking systems, neglect of improved mechanical appliances in working the traffic, excessive hours of labour, etc. It must be evident, therefore, that in any case if the public safety is to be effectually provided for, some further means must be adopted than those comprised within the duties of this committee, and I shall hereafter direct attention to the effect that their management has had in promoting safety in railway travelling.

Subsequent events proved most of Mr. Galt's fears to be groundless. A standard rule-book was prepared by this committee, who submitted it to the General Managers' Conference, and it was approved by them in March 1876 and adopted by all the companies except the small ones such as the Cambrian, Taff Vale and Rhymney. One of the earliest duties of the Author when he started his railway career was in connection with the adoption of the new book by the Midland Company.

The same committee formulated a standard block telegraph code. The need for this was impressed on the companies by the Canonbury accident of December 10th, 1881, when a signalman on the Great Northern R. allowed four passenger trains to follow one another towards Canonbury Junction on the North London, causing three collisions and leading to 5 persons being killed and 15 more or less seriously

injured. A train had broken down on the North London R. east of Canonbury Junction, which held up all the traffic, and the first train was delayed at Canonbury Junction home signal. When the Great Northern man offered the second train the North London signalman replied by six beats which indicated "obstruction of line, (positive block.)" The G.N. man alleged that he received seven bells which signified "obstruction to line to station in rear, (permissive block)" and he let the second go, then the third, and subsequently the fourth. The standard block code was universally adopted in 1884.

Prior to the introduction of the standard code it had been considered necessary to revise the standard rule book, and in November 1883 a revised edition was issued.

The chairman of this committee was Mr. E. M. Needham, of the Midland R., and as he was the Author's first chief, the following resolution passed at a meeting of the Superintendents' Conference in January, 1900, may be pardoned. It is extracted from Mr. Neele's *Reminiscences*.

The superintendents of the railways of Great Britain desire to express to Mrs. Needham and Sir James Allport their sincere sympathy in the heavy loss they have sustained by the death of Mr. Needham, and at the same time to place on record the high estimation the superintendents entertained of Mr. Needham's remarkable ability and sterling worth, the debt of gratitude they feel

for the great pains he took with so able a result, in the various revisions of the Clearing House Book of Rules and Regulations for working Railways including the Block Regulations, and their appreciation for the wise counsel, friendly guidance, and unvarying courtesy displayed by him on all occasions during the many years he has represented the Midland Railway as a member of the Superintendents' Conference.

An important matter that was dealt with by this committee was for protecting trains that have beeu shunted from one main line to the other to allow more important trains to pass. The need for such legislation became apparent by the Norton Fitzwarren collision of November 1891, when a goods train was shunted from the down to the up line for a faster down train to pass and was forgotten by the signalman, who lowered his signals for an up special passenger train, which came into collision with the standing train. Numerous schemes were submitted to meet this, and, particularly, special interlocking, but the precaution generally adopted is the "blocking-back" block signal, whereby before a man allows a line to be fouled he has to intimate his intention to the signal-box in the rear and the man there then turns his block instrument so that it gives the same indication to him and to the man where the shunted train is, as though a train were in the section.

Yet another matter has been the use of the "warning arrangement" or *section clear but station or junction blocked*. This was a block

signal used in order to avoid delays, and introduced on the L. & North-Western in 1874. If a train was shunting at a station and a train was signalled from the box in the rear, it was, under this rule, permissable for the second train to be allowed to leave the box in the rear after the driver had been verbally cautioned. It was also used at junctions for converging trains where delays were likely to arise if one train were kept back at the box in the rear until the first had passed, which is the essence of the absolute block system. In 1892 two serious collisions occurred where this rule had been in operation. One was in May, at Derby Junction, Birmingham, where a Midland train ran by the signals and into a L. & North-Western, causing 2 deaths and injuries to 66 persons, and in June, at Esholt Junction, another collision occurred causing five deaths and injuries to 30 persons.

These collisions led to severe disapproval of the use of the "warning arrangement" by the Board of Trade, and in the annual report for the year 1892 it is stated: "The Board of Trade have communicated with the Associated Railway Companies as to their mode of working at junctions, and as to securing a more uniform method of signalling trains, and there is reason to hope that alterations may be introduced to prevent the recurrence of accidents arising from this cause."

It is the Rule Book Committee of the Superintendents' Conference that deals with all ques-

tions relating to working. Reference has already been made to the standard rule book and block code. They have also dealt with, and are still considering, the question of fog-signalling including the various schemes whereby this is proposed to be done mechanically, and they also assisted in bringing about the universal adoption of the brake system of passenger communication.

Other committees of railway officers meeting at the Railway Clearing House have dealt with such subjects needing uniform action as continuous brakes, the vestibule gangways in corridor trains, the location of the third rail in electrical working, steam-heating pipes, the carriage of explosives, etc.

CHAPTER XIV.

Some Common Causes of Accidents and their Remedies.

It is hard to prove from figures what are the most common causes for accidents to passenger trains. The Board of Trade returns, for instance, give the number of passengers killed and injured by "collisions between passenger trains or parts of passenger trains," but do not show in that return whether such collisions are due to signalmen's errors in block working, whereby two trains were in one section together, or whether they are due to drivers passing signals at danger. Nor will the Board of Trade reports on accidents assist us, as they do not hold inquiries into those cases where no passenger is killed or where the facts are quite clear or which do not reveal any signs of negligence of supervision or deficient regulation.

But if the reports on accidents during the year 1907 are examined it will be found that the causes assigned to the 29 cases that were inquired into are :—

Driver over-running signals in fog ...	5
,, ,, ,, ...	4
Signalman's negligence in operation ...	4
,, ,, in block working ...	3
Shunter's negligence	3
Excessive speed	2
Distortion of road due to excessive heat ...	1
Unexpected obstruction	1
Train divided—both parts collided	1
,, ,, rear part run back & collision	1
Failure of signal	1
Miscellaneous	3

A close study of railway accidents will, however, prove that there are three heads under which the majority of collisions may be placed :—irregular block working, drivers passing signals at danger, and signals missed in fog. There used to be a fourth head—collisions with buffer stops of which there were 30 cases reported on between January, 1889, and June, 1896, but the items under this head have grown less year by year. This, no doubt, is due to a more rigid enforcement of the rule that trains must enter terminal stations at "hand-brake speed," i.e., at such a rate that the train can be stopped by the use of the hand-brake alone.

The collisions due to irregular block working are caused through the signalman at the box in advance accepting a second train before the first has arrived, or to the man at the box in the rear admitting a train before it has been properly accepted by the man in advance. It is very difficult, often, to properly allocate the blame in such cases, as although train register books are kept in which are recorded the times at which the various block signals are sent, yet the entries cannot be guaranteed, and it becomes then a case of cross-swearing.

A remedy for irregular block-working is the provision of what is known as "lock-and-block," whereby the locking frame is interlocked with the block instruments and the instruments are controlled by a track device operated by the train. By this the signalman at the box in

advance cannot give the "train-arrived" signal unless the train has arrived, and the man at the rear cannot lower his signal for a train to go into the next section unless the man in advance has accepted the train.

It stands to reason that this system, which is extensively used on the Southern lines, and on the Great Eastern and others, has saved many an accident, but it has not been universally adopted. There are reasons for this which are duly noted and dealt with in the Author's *Power Railway Signalling* wherein the system is described.

In connection with the matter of Railway Accidents it should be said that "lock-and-block" was often submitted by a former generation of inspecting officers as a remedy for block irregularities, and out of the 60 cases that were reported on between January, 1889, and June, 1896, it was mentioned in 18 reports. Probably, however, for the reasons given in *Power Railway Signalling* this has not been suggested in any report since.

In the same work is noticed another method whereby irregular block signalling is met. This is by the use of track-circuits. The rails are bonded together by a light iron wire, and formed into an electrical circuit or series of circuits. At the outgoing end of the section is a track battery, and at the entering end is a relay controlling the signal or its lever in the locking frame. This relay is electrically joined to the

track battery through the rails and normally is energised and allows for the signal to be lowered. But when a train enters the section the wheels short-circuit the current from the battery so that the relay opens and the signal goes "on" and remains there until the train has passed out of the section when the battery again opens the relay.

It cannot be claimed that this system is perfect, and it has its faults and is costly too, but it meets most of the objections to "lock-and-block."

Drivers passing signals at danger either through carelessness or from lack of knowledge of the road is a cause that is hard to meet. For men to pass signals during fog there is some excuse, but during recent years there has been sadly too many cases where this has been done in clear weather, and in this category are not included accidents like Grantham, Elliot Junction and Shrewsbury, but like Thringley Junction (see next Chapter) and Guisborough Junction in January last (1908) and probably the case at Woodhouse East Junction last February. In these cases stop signals were passed at danger.

This serious offence has caused so many disasters in America that Automatic Train Control is likely to be forced upon the companies by the Interstate Commerce Commission.

This question of passing signals at danger is very much mixed up with the matter of

signalling during foggy weather. This point is considered in connection with the collisions at Cudworth, Ulleskelf and Wimbledon in the next Chapter so that all that need be added here is that if any system of signalling in the cab of the engine were adopted it would meet those cases where danger signals are passed in clear weather too.

CHAPTER XV.

Some Recent Accidents and their Lessons.

If the twelve or fourteen serious accidents of the last four years are studied, many items of interest may be found. But before looking at those the Author would like first to refer to that at Slough of June 16th, 1900, where a driver ran by the distant and home signal at the Dolphin Box and the distant and home signal at Slough East Box. His train then came into collision at a speed of 25 or 30 miles an hour, with a train standing in Slough station, causing the death of five passengers, serious injury to 35 and minor injuries to 90. The fireman fortunately saw the home signal at danger, and he at once closed the regulator, attracted his driver's attention and applied the vacuum brake. The accident caused considerable notice, as there was nothing to account for the driver's action—or want of action. In view of subsequent events at Grantham, Goswick and Shrewsbury this accident is included in this review. In his report Colonel Yorke first criticises the negligence of the guards in not keeping a look-out. He said:—"It is to be remarked that in this case, as in so many others of late years, the

guards of the express train were not on the look-out for the signals, and neither of them can give any information as to the position of the signals at the Dolphin and Slough East. Guard Kelly, who was in charge of the train, excuses himself by saying that he was attending to the luggage and mail bags, but that when not so occupied he 'would be looking out for signals,' which means that he regarded it as his primary duty to sort luggage and letters, the watching for signals being a secondary consideration. In this view of his responsibilities Kelly was supported by the officers of the Company. I regret very much that my opinion in the matter is at variance from theirs. I hold that the first duty of a guard is the safety of his train, and the watching for every possible indication as to whether all is right or not. For this purpose the guard is given control over the vacuum brake, whereby he can stop his train if be observes anything wrong. Had either of the guards of the 1.15 train been on the alert and seen the signals at the Dolphin, he could and should have averted the catastrophe by stopping the train as soon as he became aware that the driver had run past the home signal at that place. I am supported in my opinion by Rule 170 (General Rule Book) which says :—

'Guards of passenger trains must, after the safe working of the train, give their next attention to the luggage, parcels and other packages entrusted to them.'

"In consequence of this collision, considerable prominence has been given in the public press to the suggestion that some mechanical contrivance working in conjunction with the semaphore signals should be adopted, to render it impossible for a driver to pass a danger signal without becoming aware of the fact. Many such appliances of varying degrees of merit have been invented, several of which have been brought under my personal observation and a few of which are under trial. Some of these cause a bell to be rung on the engine, or the whistle to be sounded, as soon as the engine has gone past a signal which is at danger. Others cause the continuous brake to be applied automatically without any action on the part of the driver, while a few in addition to operating the brake go so far as to aim at shutting off steam. Some are wholly mechanical, some depend on electricity or magnetism, some are partly mechanical and partly electrical. They all consist of two parts, one an apparatus placed alongside of, or between the rails and connected by rod or wire with the signal in conjunction with which it works, the other an attachment on the engine, the operation of which depends upon the position of the apparatus on the ground, which in turn depends upon the position of the signal. The object aimed at by such a device is to substitute the (assumed) reliability of a machine for the uncertainty of the human agent—or driver. It is impossible to

adequately discuss the subject within the limits of this report, but one or two remarks may be made with a view to removing certain misconceptions. The efficiency of such an appliance would depend upon the care and intelligence bestowed upon the maintenance of its separate parts. Human agency is therefore not eliminated; the reliance withdrawn from the driver, is merely transferred to man or men whose duty it is to look after the new apparatus. But even with the most careful maintenance, some portion of the mechanism might suddenly fail or be thrown out of gear, in which event the most dangerous condition of affairs would arise. For drivers, having been taught to rely upon the apparatus, would pay less heed to signals than at present; in fact one newspaper in describing some recent experiments with one of these inventions speaks of it as 'minimising very greatly the importance of semaphore signalling,' —a consummation by no means to be desired. Unless therefore it can be rendered absolutely proof against failure under all conditions of speed, weather, or accident, the use of such a machine may introduce greater risks than those which it was intended to remove. It is also to be borne in mind that if used at all on any railway, it must be used in connection with every 'stop' signal, and although the fixing of some such apparatus alongside a railway track for the purposes of experiment or demonstration is a simple operation, I anticipate that

considerable difficulty would arise, when laying down a large number of these appliances at large stations or junctions, especially where signals are 'slotted' or controlled from two signal boxes, or where several routes, each with its separate signal, diverge from one trunk line."

These observations will suffice to show that the conditions to be met are by no means so simple as may at first sight appear, while the inventions claiming to attain the object in view, which are now before the railway companies, have not yet emerged from the experimental stage.

On October 3rd, 1904, a Great Western express was derailed between Llanelly and Loughor. It was drawn by two engines, the front one of which was a saddle tank engine. Whether the derailment was due to the oscillation of the tank engine, which was travelling at 50 miles an hour, or not, was not cleared up, but Colonel Yorke in his report said:—"The knowledge gained in this and other inquiries, in which tank engines of various classes have been concerned, makes it apparent that the question of the behaviour of tank engines of all types and classes, under different conditions of speed, requires investigation. I therefore suggest that the Associated Railway Companies be invited to appoint an expert committee for the purpose of inquiring into and reporting upon the subject, after which a classification of these

engines might be made according to the work for which each type is found to be suitable." So far as the Author can ascertain no action was taken by the Board of Trade on this recommendation, possibly because a white paper (c. 2,538) was presented to Parliament in May, 1905, giving a return of the cases of derailment of engines of passenger trains in which inquiries have been held by the Board of Trade during the 20 years ending December 31st, 1904. Although the question of using tank engines on fast trains and running them with bogie in front had frequently arisen before the Loughor accident, it is strange that the question has not cropped up since, although they are still so used.

The derailment of the Great Central newspaper train at Aylesbury on December 23rd, 1904, was, as Colonel Yorke remarked in his report, so far as the destruction of rolling stock is concerned, probably one of the worst cases of derailment that has occurred in the United Kingdom. There was a dense fog prevailing at the time, and the driver did not know his road very well, and possibly he either forgot the dangerous curve then existing at Aylesbury, or in the fog failed to locate himself. The reason the Author has included this accident is to enable him to quote the remarks of Colonel Yorke as to the use of distant signals in such cases which are as follows:—

I believe that upon French railways a special signal (signal de ralentissement) is used for the

purpose of warning drivers when they have to slacken speed. In England, no such signal has been adopted, but it suggests itself to me that in a case like the present the distant signal could be utilised. The way to do this would be to keep the distant signal permanently at danger, so that it would act as a constant reminder to drivers that speed is to be reduced. Such an arrangement would have the further advantage of insuring that when the signal is at danger, detonators would always be placed upon the rails alongside it in time of fog, so that a driver would receive the warning in foggy weather as well as in fine. Objections are sometimes raised to any suggestion for fixing distant signals at danger on the ground that drivers may get into the habit of ignoring them. I do not see much force in this argument. If it has any weight at all, it would apply equally to "speed boards," "whistle boards," and other fixed notices. Drivers are supposed to be guided in their running almost entirely by signals, and if at any spot it is necessary at all times to give the driver warning that speed for any reason has to be reduced, there is no logical reason for not giving him that information on every journey, and the distant signal affords the readiest means of doing so.

One result of this report was a modification in the Great Western Co.'s method of treating distant signals.

The next accident to be noted is the Cudworth collision on the Midland R., when, about 3.37 on the morning of January 19th, 1905, the up Scotch express ignored several distant and stop signals and caught up and ran into the up mail, derailing both engines of the express into which the greater part of the train ran and was destroyed, causing seven deaths. A down

express had a narrow escape of running into the *debris*.

The original cause of this disaster was a fog, and a contributing factor was the illness of the regular "call-man," as, when the fog came on suddenly, some time was lost in getting another man to go and call the fogman. Major Pringle in his report criticises the company's arrangements in relation to fogsignalling. He said :—

Where such facilities do not exist, or cannot be provided, it should be possible to elaborate a system by means of which no valuable time shall be wasted in warning fogmen that their services are required. The men employed to fog distant signals are the first required on the ground, and for safety of traffic are by far the most important.

Dealing with this concrete case, Blackburn and Woolstone are the two men whose services, in case of fog at night, are most urgently needed. I suggest that, if these men cannot be located in railway quarters, the Company should ensure, by renting if necessary, that they occupy houses in close proximity to the scene of their duties. Again, where no other means can be provided for calling fogmen, two men at least should be appointed to call them out, so that, in case of illness,—which should be immediately reported,—a second man may always be available, who is well acquainted with the position of the various houses occupied by the fog-man. It should, further, be no part of the duty of a regular fog-man, such as Woolstone, to call other men before proceeding direct to his own post. The provision of detonators has also to be considered. Fog-men generally obtain their supply either from a signal box or a station, and are in the first case unable to comply with the instructions contained in the last paragraph of Rule 80 (a).

The duplex detonator now in common use is not a safe thing to leave about, and is more costly than the old type, but it should be possible with due regard to safety, to arrange to store detonators, at all events for men who fog distant signals, at some points on the railway which the men have to pass on their way to report themselves for duty. This collision might, it appears, have been minimised, if not altogether averted, if Woolstone had been able to supply himself with detonators before reaching Storr's Mill signal-box.

The question of mechanical fog-signalling arose in this case, and this Major Pringle dealt with as follows:—

Turning now to other methods of fog-signalling which have been invented to do away with the necessity for employing fog-men at signals, these methods possess the great advantage of being available for use at all times. But two points have to be established before the adoption of any system of purely automatic or purely mechanical, fog-signalling can be advocated in preference to the manual system now chiefly in use on English railways. Firstly it must provide both a positive as well as a negative indication—in other words it must duplicate the safety as well as the danger position of signals. Secondly it must be absolutely reliable under all conditions, otherwise it will be worse than no system at all. Some of these inventions show promise of meeting these requirements, but have not been submitted to long enough practical trial to prove their reliability. Others require further elaboration to provide the dual indication. It is not clear that the possibility of replacing the manual system of fog-signalling by one or other of the more promising of these inventions has received sufficient consideration at the hands of railway companies generally.

The collision between an electric train and some coaches at Hall Road, Lancashire & Yorkshire R. on July 27th, 1905, will probably be remembered. It is only necessary to say that Colonel Druitt in his report said :—

> The only lesson to be learnt from this calamity is the very old one, viz. : of the necessity at all times of complying exactly with all rules and regulations, and that punctuality and fast running must always give way to safety requirements.

Another fatal accident in the same year occurred at Witham on the Great Eastern R., on September 1st. This was a derailment, and for some time no reason could be found for it, and the Author believes that Colonel von Donop was about to send in his report to that effect when evidence was suddenly forthcoming as to the road having been disturbed just before the train passed, and this cleared up the mystery.

Ten months elapsed before another serious accident occurred and then, on July 1st, 1906, a boat special from Plymouth to London by the London & South-Western R. was derailed at Salisbury. Out of the 43 passengers on the train 24 were killed and 7 seriously hurt. Four servants were also killed. The cause of this accident was very clear. At the east end of Salisbury Station there is a curve over which the speed is limited to 30 miles per hour. The train, however, passed through the station at 50 or 60 miles an hour, and be-

came derailed at the curve. The cause therefore is plain, but the reason why such a careful driver failed to obey his regulations is not known. It was the first time that the man had had to drive this special, and, possibly, the first time he had run through Salisbury without stopping. It may be that with always having started his train from dead on previous trips he had not appreciated the danger of the curve, or, perhaps, in his anxiety to keep time he had taken chances. It is on record that two circulars had been issued by the "running" department to drivers intimating that this train must be run to schedule time, and any man running in advance of the timing would be taken off his engine. There was, therefore, no need for the man to show undue haste.

The only point in Major Pringle's report that should be put on record is the following as to speed:—

The question of proper speed limits is a complex one. A wide margin on the side of safety is expected and allowed for on British railways. It is well also to consider the desirability of providing comfort as well as safety in travelling. In the case of a sharp curve the point of danger is reached long before there is theoretically any imminence of overturning. But there is also risk of serious oscillation, severe impact, etc., which will cause apprehenson of danger and discomfort long before the actual point of danger is attained. Allowance has also to be made for the difficulty of accurately gauging speed.

As regards the curve at the west end of Salisbury Station, a maximum speed limit of 30 miles an

hour, provided that the required superelevation is supplied, meets both the requirements of safety and comfort. But for the curves at the east end, (where the derailment occurred) the case is different. A speed of 30 miles an hour is outside the limits of danger, if the permanent way is stiff and in good order as in this case. But such a speed would require the maximum superelevation shown in the engineer's tables, and this would have to be provided all through the first curve. The circumstances do not appear to permit of this provision. Without this superelevation a speed of 30 miles an hour would mean discomfort in travelling and possibly cause alarm in the minds of passengers. There is also the junction crossing, with reverse curves of 7½ chains radius, which commences on the east side of Fisherton Street Bridge, to be considered. Here no superelevation to speak of can be given. I do not think therefore it would be wise to allow a higher speed than 15 miles an hour on the curves at the east side of the station.

It is for consideration whether it would not be advisable for the distant signals at each end of the Salisbury yard to be held at danger with the object of emphasizing the speed limits.

Railway companies have to contend with many difficulties which are the natural result of their lines having been laid out in early days before experience was gained, and when high speeds were never contemplated. Many improvements have been carried out in the perfecting of the permanent way, rolling stock, signalling, etc., in order to enable traffic to be worked safely at express speeds. But further improvements in the way of alignment and inclination will assuredly become necessary, if companies desire to place themselves in a position to meet a demand for long sustained high-speed travelling. This condition is one that has to be faced.

Within four months—on September 19th,

1906—occurred a similar derailment at Grantham, but here the reason was harder to find. The train should have stopped in Grantham Station, but, instead, it ran through. Grantham is the point where the line for Nottingham branches off. The connecting line has a nasty reverse curve in it, and a speed limit of 15 miles per hour was laid down. No inconvenience has been experienced by this curve as all passenger trains using it stop at Grantham. As just said, this train, which was for the North, should have called at Grantham and waited 5 minutes. The signalman therefore was justified in allowing a goods train to pass from Nottingham, which meant setting the trailing points of his junction for Nottingham, and, in accordance with standard interlocking, the facing points were also "made" for that direction. The signals consequently for the line to the North were at danger, also those for Nottingham. The train ran through the station and on to the curve which the engine took all right but the tender left the road and the whole train was wrecked.

No reason could be assigned for the non-stopping of the train. Various causes were suggested, but the only practical one was that the driver, who had not enjoyed good health, was taken ill on the footplate, and that the fireman—both men were killed—did not realise this in time to take action to stop the train.

On November 24th of the same year there

occurred a collision on the North-Eastern R. at Ulleskelf, which was never properly accounted for. Here the driver and fireman were killed and cannot explain why their train ignored the distant and stop signals at two signal-boxes, so that their train came into collision with a mineral train. There was a fog at the time, of varying density, also a train running parallel, but slightly in advance, and possibly from one or both of these causes the men's view of the signals was obstructed. There were no fog-men out,—just as at Cudworth—and the Author suggests that as no detonator is exploded when the signals are "clear" so at Cudworth and Ulleskelf the drivers were misled in believing by getting no warning that the signals were in their favour.

Mechanical fog-signalling again cropped up in this case, and this is what Colonel von Donop said thereon :—

This accident, like several previous ones, points to the desirability of the provision of some reliable mechanical contrivance to notify to a driver that he is running past a signal. Several railway companies have been and are, at work on this problem, and a large number of patents have been taken out by inventors who claim to have solved it. The North-Eastern Railway Company has itself for some years past been experimenting with an apparatus designed for the purpose by one of their officials, and it is at the present time under trial on some of their lines. The problem is not, however, nearly as simple a one to solve as it appears at first sight, and the Company recognise that, though their type

has already been frequently modified, it does not yet completely fulfil all the requirements which are considered necessary. On that account its use is not being further extended at the present time on their system, but they state that they are still at work on it, endeavouring to perfect the apparatus with a view to its more general employment. The introduction of a more reliable apparatus for the purpose is urgently needed, and the matter is therefore one which calls for the attention of all railway companies.

On December 28th, 1906, there occurred on the Dundee and Arbroath Joint R. one of the worst collisions on record for this country. A severe snowstorm had raged for days, and traffic were completely disorganised. An up local train had been allowed to leave Arbroath, and this was standing in Elliot Junction station waiting for the pilotman to conduct the train over the down line, the up line being blocked by some wagons derailed by snow. A second train was permitted to leave Arbroath within 15 minutes of the local train. The block system was broken down, and therefore the driver was duly warned and the signals at Elliot Junction were against him, but he failed to bring his train to a stand, and a terrible collision ensued in which 22 lives were lost.

It is easy to make suggestions as to the driver's conduct, but he has paid the penalty for his offence, he being one of the only two men—the other was the driver in the Leyland collision of 1898—who have, during recent years, suffered imprisonment for this offence on a manslaughter

charge. It is only fair to the driver to say that the inquiry showed great lack of initiative and intelligence on the joint line and an absence of observance of the rules for signalling during falling snow.

The first accident of the year 1907 to be noticed was one of which little was heard. It occurred at Thringley Junction, near Chippenham, on the Great Western R. on January 16th, and was caused by the driver of a passenger train ignoring the warning he had received at the box in the rear under the warning arrangement described on p. 58, and approaching the junction with so little care that he overran the stop signal, fouled the junction, and met a goods train going in the opposite direction.

This accident is included herein in order to quote what Colonel Yorke said about careless railway servants. He observed:—

Frequent accidents have occurred owing to the disregard of "stop" signals by engine drivers, and it would seem that these men do not always fully realise their responsibilities, or attach sufficient importance to the necessty of absolute obedience to signals. Railway companies are compelled by Act of Parliament to spend large sums of money in providing signals and other precautions for the safety of the traffic, and are under heavy penalties for non-compliance with the requirements of the Board of Trade in this respect. But all this expenditure is wasted unless the signals are obeyed by the men for whose information and guidance they are erected. An engine-driver can hardly commit a more serious offence than to run past a signal when it is at danger. Occasionally, if an accident from this

cause, involving fatal injuries to several persons occurs, proceedings are taken by a public authority against a railway servant or servants concerned for culpable negligence, but in the numerous cases in which the results are less grave, although the lives of many passengers may have been seriously imperilled by the failure to observe signals, nothing is done. It is doubtful whether the majority of railway servants are aware that under the Regulation of Railway Acts of 1840 and 1842 statutory penalties are attached to certain offences whether due to wilfulness or negligence, whereby danger is caused to the public or to persons on the line.

The Author has looked up the Acts of 1840 and 1842, and this is what is there laid down :—

Section XIII. of the Railway Regulation Act of 1840 (3 & 4 Vict., Ch. 97) says :—

It shall be lawful for any officer or agent of any railway company or for any special constable duly appointed and all such persons as they may call to their assistance to seize and detain any engine-driver, guard, porter or other servant in the employ of such company who shall be found drunk while employed upon the railway or commit any offence against any of the bye-laws, rules or regulations of such company, or shall wilfully, maliciously or negligently do or omit to do any act whereby the life or limb of any person passing along or being upon the railway belonging to such company, or the works thereof respectively, shall be or might be injured or endangered, or whereby the passage of any of the engines, carriages or trains shall be or might be obstructed or impeded, and to convey such engine-driver, guard, porter or other servant so offending, or any person counselling, aiding or assisting in such offence into custody without a warrant. The penalty for such offence to be im-

prisonment with or without hard labour for not exceeding two calendar months, or a fine not exceeding ten pounds.

By Section XVII of the Railway Regulation Act, 1842, this clause was amended so as to apply to "Any engine-driver, wagon-driver, guard, porter, servant or other person employed by the said or by any other railway company, or by any other company or person in conducting traffic upon the railway belonging to the said company, or in repairing and maintaining the works of the said railway."

Section 34 of the offences against the Person Act of 1861 (24 & 25 Vict., Ch. 100) provides that anyone who "by any unlawful act or by any wilful omission or neglect shall endanger or cause to be endangered the safety of any person conveyed or being in or upon a railway or shall aid or assist therein shall be liable to imprisonment for not exceeding two years."

Another accident of which little was heard as it concerned a goods train only, and yet which bore a strong resemblance to Grantham, and the later derailment at Shrewsbury, occurred on the North Eastern R. at Goswick on August 28th, 1907.

An express goods train had to be turned into a loop line in order that an express passenger train might pass it. The signalman at Goswick therefore kept his signals "on" in order to warn the driver that a train was ahead of him on the loop, but the train ran by all these signals, and as the road was "set" for the loop the train went through the connection,

which was not constructed for high speed, so the engine left the road, fell over into a ditch and was followed by the greater part of the train. The driver and fireman were both killed so no explanation for their action is forthcoming. The engine was in good order, and the brakes, and that the men, or one of them, were not asleep is shown by the whistle given when running through the station and approaching the level crossing there.

An old question was here revived by the following remarks in the conclusion of Colonel von Donop's report:—

One further point calls for remark in connection with this accident. The two goods trains concerned in it were due to leave Tweedmouth at 11.10 p.m. and 11.22 p.m. respectively, whilst the two express passenger trains also concerned in it were not due to arrive there till 12.18 a.m. and 12.32 a.m. respectively. Had the goods trains therefore started punctually to time, they would both have been about an hour in front of the express passenger trains, and they would both have been able to run through on the up main line without any shunting or delay, and this accident would not have occurred. But the fact of both the goods trains starting about an hour late placed them immediately in front of the express trains, and entailed the delay and shunting between Goswick and Beal which resulted in this accident. It may, therefore, be regarded as one of the numerous accidents which would not have occurred if punctuality had been observed.

The Shrewsbury disaster of October 15th, 1907, will still be in our memories, but it is

necessary to place the facts upon record. The 1.20 a.m. L. & N.W. express from Crewe to Shrewsbury, instead of being pulled up at Crewe Bank signal-box outside Shrewsbury Station, ran by the signals there, and the junction signals at the entrance to the station, and was derailed at a V crossing, causing 18 deaths.

The accident itself attracted considerable attention, but the report of Colonel Yorke attracted much more, on account of the conclusion he arrived at that the driver was asleep. In the Author's opinion this was probably the case, but it is doubtful whether it was wise to say so as definitely as the Colonel did. He proved that the engine was in order and the brakes, also the permanent way, but was it not possible that the fire was giving trouble and that the driver and fireman had been gazing into the firebox and, becoming temporarily blinded, had lost their bearings, which, added to the probability that they were further on the road than they thought, caused them to be on to the junction sooner than they were prepared for? Anyway, the accident was very disquieting, especially after those at Salisbury and Grantham, and so the following very full extracts from Colonel Yorke's report may be justified:—

Suggestions have appeared in the public press, or have been forwarded either to the President of the Board of Trade, or to myself, to the effect that the brakes on the train must have "failed," and

this appears to have been the view taken by the Coroner's jury, who, after a verdict of "Accidental Death," added a rider "that the brake power of the train was insufficient." I am ignorant of the reasons on which this rider is based, as the jury heard no evidence regarding the braking power of the train, and on such evidence being tendered by the Solicitor of the London and North-Western Railway Company, they declined to receive it. Nor is it clear what is meant by the statement that the brake power was "insufficient." The total number of wheels in the train (including engine and tender) was 122, and of these all were braked except 14; the total weight of the train was 392 tons, of which all but 42 tons was carried on braked wheels. If, therefore, the brakes were in proper order, the brake power of the train was amply sufficient. It is presumed that what the jury meant was that the brakes were out of order.

It is a very easy thing at all times to say that the brakes "failed," and very difficult to disprove, and such suggestions, if not based on positive evidence, require the closest scrutiny. During the past twelve months letters and articles of a disquieting nature have appeared in the technical press in which attention is drawn to the alleged risk of the displacement of the ball valves of an old-fashioned pattern of vacuum brake by centrifugal forces, when a train is travelling round a sharp curve at high speed; the effect of such displacement being to render the brake inoperative. It is not necessary to discuss this matter here. It is sufficient to say that in the present case the question does not arise, as for three miles outside the junction the line is either straight or the curves are of such large radius (the sharpest has a radius of 90 chains) that there is no possibility of the centrifugal force having had any effect on the ball valves.

But a failure of a brake may be due to other causes than this, namely, to the brake pipe not being

connected up between the engine and train, or between the coaches, or to a stoppage in the brake pipe, or to some serious defect in the brake apparatus or rigging. In this case the train was composed of vehicles belonging to three companies, viz., the London and North-Western Railway, the Great Western Railway, and the Caledonian Railway (some of them being the joint property of the London and North-Western and the Caledonian Railways). They were all fitted with the vacuum brake, with certain differences of detail. It is hardly possible, within the limits of such a report as this, to describe and illustrate all these differences of detail. To do so would necessitate an explanation of all the principles and features of the automatic brake. A bare enumeration of the different patterns of brake in use on the train must therefore suffice. Two of the London and North-Western Railway eight-wheeled coaches had each what is known as a double vacuum cylinder (or sack) with two diaphragms, two independent sets of brake gear, and one ball valve; the other two London and North Western eight-wheeled vehicles had each two rolling ring brake cylinders, with separate ball valves, the latter being arranged transversely to the length of the coach, and right and left-handed; the four six-wheeled vehicles of the London and North-Western Railway had each a single vacuum sack with diaphragm and ball valve; the three Great Western eight-wheeled vehicles had each a single vacuum cylinder, with rubber piston bands (an arrangement which dispenses with the use of the ball valve); the two eight-wheeled West Coast Joint Stock coaches had, in one case a double vacuum cylinder with two diaphragms, etc., and ball valve, and in the other, two separate rolling ring cylinders and ball valve; the West Coast Joint Stock six-wheeled fish van had a vacuum sack and ball valve, and the Caledonian truck had a rolling ring brake cylinder and ball valve.

Guard Birch, who was in charge of the train, and was travelling in the rear brake van, says that the brakes were tested in the usual manner, and in accordance with the regulation already quoted, before the train left Crewe. The mode for testing the brakes is for the driver, after the train has been coupled together, to create a vacuum in the "train-pipe" by means of the ejector on the engine, when the amount of vacuum so produced should be recorded not only by the gauge on the engine but also by the needles of the gauges in the guards' vans; the rear guard then opens the brake valve in his van and partially destroys the vacuum, which should cause a corresponding backward movement of the indicator needles in the vans and on the engine, and at the same time cause the brakes to be applied to all the wheels. It is then necessary, before the train can start, for the driver to re-create the vacuum in the train pipe, so as to release the brakes which have been so applied. Guard Birch's statement as to the testing of the brakes, taken by itself, would not carry much weight, but it happens that the test was witnessed by foreman porter Ridgeway, who was on duty on the platform, and who says that the test was made in a proper manner, and with satisfactory results. If this triple operation was properly performed, and if the movements of the indicator needle in the rear van corresponded (1) with the creation of the vacuum, (2) with the reduction of the vacuum, and (3) with the restoration of the vacuum, it is a certain proof that the brake pipe was correctly connected up right through the train, that the pipe was free from obstruction, and that the apparatus on the engine for producing the vacuum was in working order. It did not, however, directly prove that the brake blocks actually moved, nor did it indicate the degree to which they moved, in response to the reduction of the vacuum by the guard. It is more than probable that in a long train, the brake

blocks do not all move with the same degree of rapidity and pressure, and that the actual braking power at the driver's disposal is less than that theoretically available. This would be due to one or other of the following causes:—(a) the existence of cracks or leaks in the rolling rings or diaphragms or (in the case of Great Western Railway stock) of the valvular piston ring, all of which are made of vulcanised rubber and liable to deterioration, such cracks causing a leakage between the upper and lower sides of the brake pistons; (b) worn brake blocks or slack brake rigging. Some such defects are ever present to a certain extent, except perhaps in the case of absolutely new rolling stock, but it is in the highest degree improbable that the whole of the brakes or the majority of them on this train, composed as it was of comparatively new or recently repaired stock of different types and belonging to different companies, were in such a condition as to be totally unserviceable.

The report in its conclusions says:—

It has now to be considered whether anything can be done to avert such disasters in the future. There has been the usual crop of suggestions, based as a rule on imperfect knowledge, and of little or no practical value. A few of them, however, seem to require notice, if only for the purpose of removing erroneous impressions from some people's minds. Amongst these is the idea that all "dangerous curves" on our railways should and could be forthwith abolished. But this is clearly impossible. It seems to be overlooked by those who advocate this course that the "danger" depends not so much upon the curve as upon the speed at which the curve is taken, and that a curve which would be highly dangerous on a section of main line where high speeds are expected, may be harmless in places (e.g. outside a large station) where low

speeds are the rule. What companies have to do, is to take steps to ensure that their regulations as to speed are obeyed. Moreover, as I have already explained, the derailment in this case occurred at the "crossing" of the "turnout" of the junction and had nothing to do with the curvature of the line at the entrance to the station; and it is absolutely impossible to abolish "turnouts" at the junctions of two lines unless all junctions are also to be abolished. It is also the fact that if there had been no junction, no curve and no derailment, an even worse disaster than the present one would have occurred, as the train would have dashed into the station at an excessive speed and would have collided with the stationary train already at the platform. In this case two trains would have been wrecked instead of one, and in addition to the passengers in the trains, many persons on the platform would have been either killed or injured. So that the abolition of the junction and curve would not have averted a disaster, but perhaps have intensified it.

Another proposal is that there should always be three men on the engines of express trains. In my judgment the presence of a third man on the footplate is undesirable. It would necessarily involve a division of responsibility, which would be bad for discipline, and lead to constant disputes. The extra man would have nothing to do, and, besides being very much in the way of the driver and fireman, he would be disposed to enter into conversation, and perhaps argument, with them. Moreover, if his hours were the same as those of the other men, he would be as likely to be overcome by sleepiness or drowsiness as they.

The provision of speed indicators, speed recorders, or "tell-tales" forms the subject of another proposal. Appliances of this nature, whether on the engine or fixed alongside of the railway, would be extremely valuable for the purpose of checking

the movements of drivers and of ascertaining the manner in which their time is spent, the speed at which they had been travelling, and the extent to which speed regulations had been observed. The adoption of speed indicators has, I believe, been made compulsory upon all French railways by the Government, and I think it would be a good thing if they were more generally in use in this country. But so far as the case now under consideration is concerned, in which the driver was asleep, any such apparatus would be perfectly useless for purposes of safety. Nor would speed boards or additional signals or lights be of any service under these circumstances.

Several writers have drawn attention to the necessity for providing signals on the engines themselves, and these have been for some time attracting the close attention of the Inspecting Officers of the Board of Trade and of Railway Companies. Such an appliance to be of any service, must be absolutely reliable and should give distinct audible signals by whistle or bell both for "safety" and "danger," inside the cab of the engine. Such signals are usually called for short "cab-signals," and more than one railway company in England is now experimenting with devices of this nature. They require a special apparatus, not only on the track but also upon every engine which is likely to travel over the line upon which they are in use. In addition to these and working either in conjunction with them or independently of them, it has been proposed to introduce "train-stops," whereby the brake is automatically applied should a train pass a "danger signal." Numerous inventions, both electrical and mechanical, have recently been brought out for operating this "train-stop," but, as a general rule, these have been found to be either too complicated or for other reasons totally unfit for railway purposes. An "automatic train-stop" without "cab-signals" is at the present time in use on some of

the underground electric railways of London, and has been found to give good results; but the conditions on these lines, especially as regards speed, are very different from those on our main steam railways, and it has yet to be ascertained whether such an appliance is applicable to steam railways on which the conditions as to speed, weight of trains, and gradients present so many variations. The question of the general adoption of "cab-signals" and "automatic train-stops" is not yet settled, and is not only receiving consideration in this country, but is also under investigation by the Inter-State Commerce Commission of America, a portion of whose report for 1907 is devoted to the subject.

In the meantime it is for consideration whether detonators might not be more extensively employed than at present for the purpose of arousing the attention of a negligent engine-driver, should he allow his train to overrun a "danger" signal, or approach a place where, owing to curves or other local conditions, danger is to be apprehended at too high a speed. Many signal-boxes are at present equipped with an apparatus whereby a signalman can, without leaving his box, place a detonator on the line at or near the home signal whenever this is at danger. But, hitherto, these devices are only brought into operation during times of fog or falling snow. If they were always in use, by day and by night, in clear weather as well as in fog, it would be impossible for drivers to pass a "danger" signal without receiving a reminder of their position. A record could be kept by the signalman of any train which thus exploded a detonator unnecessarily, by which means the driver at fault could be traced, and suitably dealt with.

When a railway accident occurs, the question usually arises as to whether the brakes of the train have been tested, either at the starting point or at any place where the engine has been changed, or where coaches have been attached or detached. It

is, as already stated, the duty of the rear guards to make this test, and whenever they are asked whether they have done so, the answer is always in the affirmative. I have no wish to cast any reflection on the general trustworthiness or veracity of guards, but I think it will be admitted that an unsupported statement made by the person responsible for the performance of an important duty cannot be regarded as conclusive, especially in cases where doubts arise whether the brake-pipe was properly connected up throughout the length of the train, or where allegations are made that for any reason whatever the brakes were inoperative. Moreover, I think it is probable, when trains are late and the guards are being hustled by the platform staff, that they are not given sufficient time for making the test. The proper testing of the brakes of a train is of such importance that I recommend that it should be performed, or at least witnessed, by the station-master, or the platform inspector, who should sign a certificate (to be retained by the guard) recording the fact that the test had been made and stating the degree of vacuum (or air pressure) indicated by the gauge in the guard's van both before and after the test, and whether the brakes showed any sign of leaking off. If some such record as this were available, many of the doubts as to the condition of the brakes, which now arise after a railway accident, would be eliminated.

The Author may add, with regard to the question of brakes, that at the request of the Board of Trade the Associated Railway Companies are making experiments in order to make sure that they have the best possible apparatus.

Within eleven days—on October 26th—a fatal collision occurred between two electric

trains on the Metropolitan Railway at West Hampstead. Fog here was the principal factor in the case, but the signalman must have manipulated his interlocking to admit the second train into the station whilst the first was standing there, unless the instruments failed. There is, however, ample evidence to show that the latter could not have happened. The discipline at the station was also shown to have been bad.

The only accident of note during the past year (1908) was the collision in a fog at Wimbledon on January 23rd. In this case a train passed a distant, home, starting and advance starting signal in the "on" position. Whilst Major Pringle did not refer to the subject in his report, it raises the question as to whether our fog-signalling methods are the best possible.

CHAPTER XVI.

Non-Train Accidents.

The annual returns of the Board of Trade include other accidents to passengers than those caused by the movement of trains. Hitherto in this work the reference has been to the passengers killed and injured in collisions and derailments, but as those who are killed and injured whilst crossing the lines or getting in or out of trains are included in the total casualties on railways some reference should be made to these.

Table XI. in the Board of Trade return deals with such cases, and this is as follows for the year 1907 :—

	Killed	Injured
From falling between trains and platforms—		
(1) When entering trains ...	21	63
(2) When alighting from trains	6	94
From falling on to the platform, ballast, etc.—		
(1) When entering trains ...	2	112
(2) When alighting from trains	4	876
From falling off platforms and being struck or run over by trains	12	12
While crossing the lines at stations—		
(1) Where there is either a sub-way or footbridge ...	5	5
(2) Where there is neither a sub-way nor footbridge ...	5	7
By closing of carriage doors	—	633
By falling out of carriages during the running of trains	31	53
By other accidents	16	277
	102	2132

The comment in the Report on these cases is :— "The bulk of them were due to misadventure or pure accident, for which no remedy could be prescribed, and comparatively few could be attributed to preventable causes." The Author does not consider, however, that the concluding remarks apply to those cases where passengers risk their lives by entering or leaving trains whilst they are in motion. Most, if not all, companies have powers to prosecute in such event, and not a few fines would soon reduce those particular figures which account for 1,178 cases out of the total of 2,234 casualties.

In the same table are figures relating to "other persons" killed and injured by the movement of trains other than in train accidents. These are :—

	Killed	Injured
While passing over railways at level crossings	50	30
While trespassing on line	278	115
Suicides and attempted suicides ...	169	18
On business at stations and sidings ...	24	124
Miscellaneous (not included above) ...	17	34
	538	321

Trespassing on railways, and suicides account for more than four-fifths of the 538 fatal cases. Trespassing on a railway is a very serious offence, not only because of the risk the trespasser runs, but for the damage he can do.

By section XVI. of the Railway Regulation Act, 1840, (3 & 4 Vict., 97) the penalty for wilfully trespassing on a railway and refusing to quit upon request, was a fine of five pounds

or, in default, imprisonment for two calendar months. By the Regulation of Railways Act, 1868,—31 & 32 Vict., 119—this was amended to read:—"If any person shall be or pass upon any railway except for the purpose of crossing the same at any authorised crossing, after having received warning by the company which works such railway or by any of their agents or servants, not to go or pass thereon, every person so offending shall forfeit and pay any sum not exceeding forty shillings for every such offence."

This was modified by the Railway Regulation Amendment Act of 1871 (34 & 35 Vict., 78) so that it read, "after having once received warning."

This is what the Royal Commission of 1874 said on the subject:

We find that no less than 1,010 persons have lost their lives during the four years while trespassing on railways. Moreover, the similiarity of the returns in different years is exceedingly remarkable. . . . Accidents of this kind will probably never be eliminated from the returns, but it would no doubt be greatly reduced if railway companies were more strict in enforcing the statutory powers they already possess and trespass upon the permanent way of railways were absolutely forbidden. Prior to the Regulation of Railways Act, 1868, a trespasser was liable to no penalty whatever unless he refused to leave the company's premises when requested to do so (3 and 4 Vict. Ch. 97, s. 16). The 23rd section of the Act of 1868, as amended by 34 and 35 Vict. ch. 78 s. 14) makes a person liable to a pecuniary penalty for trespassing upon railway

premises "after having once received warning not to go or pass thereon." We think these provisions which go beyond the recommendation of the Royal Commission of 1865 are amply sufficient to enable the companies to deal with trespassers upon their stations and premises generally. But in view of the lamentable loss of life here noticed, we hint it would be desirable to mark the distinction which is so well understood by the public, between the railroad proper and railway premises, and that trespassers upon the permanent way ought to be made liable to a penalty without the condition now required of a warning to desist.

Some companies possess powers whereby they can prosecute trespassers without any warning. The Lancashire and Yorkshire obtained such powers under section 36 of the Lancashire & Yorkshire Railway Act, 1884—47-48, Vic., Ch. 145, which reads:—"And whereas accidents frequently arise by persons trespassing on the railways, stations, works, lands and property belonging to or leased or worked by the company, or the company and some other company, and many persons so trespassing have been killed and others have been severely injured, and it is necessary that more effectual remedies should be provided for the prevention of trespass on those railways, and the stations, works, lands and property connected therewith. Be it therefore enacted that any person who shall trespass on any of such railways, stations, works, lands or property in such manner as shall expose himself to danger or risk of danger, shall without having received any personal or

other warning than hereinafter mentioned forfeit and pay by way of penalty any sum not exceeding forty shillings for every such offence, and the provisions of the Railway Clauses Consolidation Act, 1845, with respect to the recovery of damages not specially provided for, and of penalties, and to the determination of any other matters referred to justices, shall apply to this enactment. Provided that no person shall be subject to any penalty under this enactment unless it shall be proved to the satisfaction of the justices before whom complaint is laid that by notices painted on boards or printed on paper, and pasted on boards or enamelled on metal or otherwise as the Company, or (as the case may be) the companies may think fit clearly exhibited, public warning has been given to persons not to trespass on the railway stations, lands, works or property in respect of which trespass is complained of, and that one or more of such notices has been fixed at the station on that railway and at the public road level crossing (if any) nearest to the spot where such trespass is alleged to have been committed, and such warning shall be renewed as often as the same shall be obliterated or destroyed, and no penalty shall be recoverable unless such warning is so placed and renewed. Provided also that no person lawfully crossing any such railway at any level crossing thereof shall be liable to any such penalty as aforesaid. And provided, lastly, that this enactment shall

not interfere with, but shall be subject to, any future general enactment on the subject of trespassing on railways."

Included in the annual report of the Board of Trade are the number of passengers killed and injured from causes not connected with the movement of trains. These were for 1906:—

	Killed	Injured
Whilst ascending or descending steps at stations	5	327
By being struck by barrows, by falling over packages, etc. on station platforms	—	96
From falling off platforms on to the ballast	2	102
By other accidents	1	266
	8	791

The annual report for 1907 condenses this portion of the return thus:—

	Killed	Injured
While on business at stations or sidings	12	494
Miscellaneous (not on business) ...	22	133

The report says, "Inquiries are seldom held into the causes of these accidents, which are rarely due to any cause but misadventure or carelessness."

CHAPTER XVII.

The Royal Commission of 1874 and Accidents To Employees.

The question of casualties to railway servants engaged the attention of the Royal Commission of 1874. During the four years 1872-5 there were 2,822 killed and 8,048 injured from causes other than train accidents. The Commission considered that the returns as to the "injured" were comparatively valueless, and they recommended that they should be carefully analysed by the Board of Trade, and a distinction made, as far as possible, between those that seriously incapacitate a man and those of a more trifling character. While admitting the importance of the subject, the Commission were still more impressed by the difficulty of dealing with it. The report says:—"We are of the opinion, as already intimated, that it is undesirable to interfere with railway labour otherwise than by the operation of general laws. Nor do we think that a case has been made out to warrant the adoption of such a course or that the change would be beneficial to the very class in whose interests it is demanded. It must not be forgotten, moreover, that this loss of life is in a large measure owing to the recklessness of the

men themselves. Familiarity with railway work produces of necessity disregard of danger, and practices involving special risks are habitually resorted to on the ground of convenience."

A petition was sent to the Royal Commission by the Amalgamated Society of Railway Servants challenging the accuracy of the returns as to the number of casualties due to want of caution on the part of the sufferers. The causes therein given were those assigned by the railway companies in reporting the accidents. The memorial contended that in the majority of cases they were occasioned by :— (1) excessive hours of labour; (2) the non-enforcement of certain of the companies' rules ostensibly made for the servants' protection; (3) the non-adoption of the most approved appliances conducive to safety in the working of railways; (4) the want of proper accommodation in the working of traffic; (5) the employment of insufficient persons for the performance of responsible duties; (6) the insufficient number of men employed. The memorial made three suggestions for the redress of their alleged grievances, viz.: 1st, that the Board of Trade should be empowered "to require companies to make such changes in all matters connected with the railways as the Board may consider necessary for the safety of railway servants; 2nd, that the Railway Commission (i.e. the Railway and Canal Traffic Commission) be empowered to arbitrate between the companies and the servants in matters where the

safety of the servants or the public is concerned; and 3rd, that the men should be given a right to compensation for injuries or loss of life due to the negligence of the companies.

The first two of these proposals were regarded as impracticable. The third raised the question of Employers' Liability, and although it has now been disposed of by recent legislation, the views of the Royal Commission are interesting, and should be put upon record.

The report said:—

The Royal Commissioners of 1865 noticed the law of liability for negligence as the greatest safeguard of the public against railway accidents, and it is generally admitted that Lord Campbell's Act has done more than all other legislation to strengthen the influences which operate in favour of the public safety. But throughout their report the Royal Commissioners dealt only with the safety of the public, and in our opinion railway servants have some grounds for seeking exceptional measures for their protection from the fact that owing to certain incidents of the law of master and servant, the law of liability upon which Parliament has relied for the safe working of railways is practically a dead letter as far as they are concerned. But all such special measures are unequal in their operation, in contrast with general laws, the influence of which is constant and even, and, therefore, we would recommend such a change in the law as will place railway servants in as nearly the same position with the public in these respects as is consistent with the principles of the law of master and servant. Whether these principles are wise and just we do not stop to inquire. We assume that they are so. But there are certain incidents in their

application to railway labour on account of which they press harshly, if not with positive injustice upon the servants. There are other spheres of employment, no doubt, in respect of which this is equally true, but we confine ourselves to the precise question which concerns us. The distinction which the law of liability for negligence maintains between a master's liability to strangers and to his own servants is intelligible; and at all events to deal with the general law is beyond our province. But the grievance of the railway servants is not that they have, in common with all other servants, to prove what the law deems personal negligence on the part of their master in order to enforce a claim for compensation, but that in their case the law, instead of attaching this liability to a master who is, in fact, and not merely by a legal fiction, a person, and can therefore be reached and made amenable, confines it exclusively to a corporation so remote from them that proof of complicity with the wrong from which they suffer is almost invariably an impossibility. The companies maintain that in about 900 cases out of 1,000 of fatal accidents to their servants the men fall victims to their own misconduct or imprudence, and the remaining cases are due to the legitimate risks inseparable from their employment. The servants, on the other hand, assert that in numerous cases they are sacrificed from causes and in circumstances which would clearly give a right to compensation were it not that the law refuses to regard in any other light than as their fellow-servants those to whom the companies delegate the master's authority.

We would, therefore, propose such an amendment in the law as will both test and remedy this grievance complained of by the servants, while it can in no respect prejudice the companies, save in so far as the position they assume in this matter is untenable. We recommend that in any action against a railway company for compensation for

the death or injury of a servant through the defendants' negligence, the officials whom the company entrust with executive authority shall no longer be deemed to be merely the fellow-servants of their subordinates; or, in other words, that where a railway servant can establish against any official of the company, empowered to direct the act or control the matter complained of, such proof of negligence as would make him liable if he were himself the master, his negligence shall be deemed to be negligence on the part of the company. We do not intend, moreover, that this should apply only where the injured servant is the subordinate of the official in default, and in the same department of work, but that the company should in every case be liable to its servants for the negligence of those to whom it delegates its authority as master.

But we do not go further than this. We do not propose that railway companies shall be responsible to their servants for the negligence of those who are in fact, as well as in law, fellow-servants. The rule of law that a master is responsible for the acts of his servants is based upon the presumption that he directs and controls their conduct; and though this is seldom true in fact, save where the relationship is immediate and simple in its character, it is, on grounds of public policy, universally maintained in so far as the interests of third parties are concerned. But the amendment we have here proposed assumes, what is practically an acknowledged fact, that there is no direct personal relationship whatever existing between a railway company and its subordinate servants. And having now recommended that the ordinary presumption of law above mentioned should be rejected when its operation is specially adverse to the servants, we cannot urge that it should be maintained when it happens to bear adversely upon the companies. Our object is merely to remove the disabilities under which railway servants rest, owing

to the fact that in their case the relationship of master is, as regards liability for negligence, a mere fiction; we refuse, therefore, to give them rights against the companies such as would imply that this relationship is not a fiction but practical and real.

If the Legislature should think fit hereafter, by a change in the general law of master and servant, to place servants in the same position, which on grounds of public policy, the law now allows to strangers in respect of a master's liability for a servant's negligence, railway labour will, of course, be affected by the alteration. But all that we now propose is that a railway company shall not by reason of its acting altogether by deputy avoid the liabilities which the existing law intends to impose upon a master towards his servants.

In the numerous gradations of railway employment some difficulty will probably be found in drawing the line distinctly between servants properly so called and the officers of the companies, who hold the delegated power of master. But we believe the distinction is clearly marked in practice, and the difficulty will arise rather in framing the law than in administering it.

Various points of detail will need to be considered in connection with this proposal, but we will specify only two. First, we recommend that a time be limited within which these actions may be brought. And, secondly, we think the legal doctrine of acquiescence should not be allowed to deprive railway servants of the benefits of this amendment of the law; or in other words the fact of a man's remaining in the service of a railway company with knowledge of the facts or circumstances which become the basis of his action ought not of itself to deprive him of his remedy.

There is another suggestion we have to offer, which may seem to be adverse to the servants, but which is really made as much in their own inter-

ests as in the interests of the public, for it is most desirable to give increased protection to the competent and prudent against the recklessness or misconduct of their fellow-servants. Under the present law acts of negligence involve practically in the majority of cases no legal penalties whatever, unless they result in fatal consequences. It therefore depends not upon the character of the act itself, but entirely upon its consequences, which are often matters of the merest chance, whether the offending party is made amenable on the grave charge of manslaughter, or escapes with absolute impunity. Moreover, there are some cases where coroner's juries hesitate to find a verdict of manslaughter, as being disproportionate to the offence and yet where some punishment ought to be imposed. The provisions of the 24 and 25 Vict. Ch. 100, s. 34, appear insufficient for this purpose, and we recommend a statutory provision similar to that contained in the Mines Regulations Act (35, 36 Vict., Ch. 76, s. 61, and Ch. 77, s. 32) that any person in the employment of a railway company who in the course of his service is guilty of any act or default of a kind calculated in the opinion of the court which tries the case, to endanger the safety of others shall be liable to a penalty on summary conviction.

The Regulation of Railways Act of 1842 (5 and 6 Vict., Ch. 55) contains a very definite precedent for such an enactment; and, indeed, if certain provisions which at present can be put in force only by the officials of the railway companies were extended and incorporated with the general criminal law, nothing more need be desired. We allude specially to section 17. We think, however, that cases of simple drunkenness, and of violating the companies' bye-laws or regulations, may still be left to the railway officials to deal with under that statute; and, further, we see no reason why any class of persons connected with railways should be exempt from the proposed enactment.

We believe the amendment we advocate would have an important bearing even upon the safety of the public, as well as upon that of railway servants. It has frequently transpired when accidents have led to public inquiries, either by coroners or by the Board of Trade, that the regulations of the company were well conceived to prevent the very casualty under investigation, but that these regulations had been wholly in abeyance. At present this fact has no influence upon the extent of a company's liability, for, speaking in general terms, it is liable to the public in all cases, and to its servants in none. But if the absence or non-enforcement of proper regulations rendered railway companies liable to civil actions in respect of the death or injury of their servants from an accident thus occasioned, an influence of a kind that is now signally wanting would operate evenly and constantly to promote proper discipline; and thus one of the most mischievous, though remote, causes of railway accidents would be reached, and in some degree mitigated.

For it needs to be observed, that the neglect of regulations and want of discipline which occasionally come to light when an accident of public interest occurs, are generally but part of a system which prevails amongst the staff, affecting their whole condition and engagements in the company's stations and yards. The importance, therefore, is obvious of giving the men themselves a direct interest in the maintainance of discipline, for, of course, a servant who was himself in default, would have no right of action for the default of his fellow-servants, and the opportunities thus afforded of calling attention to indiscipline where it prevails would lead to its being detected before it results in a public catastrophe. We have already noticed the effect of want of discipline and order as leading to irregularity in the traffic. This, again, results in disarranging the hours of work of all classes of

railway servants, and necessitating their being kept on duty for an excessive period. Their own safety is thus endangered, owing to their becoming listless and less competent, through fatigue or want of rest, and upon occasions the safety of trains is thus imperilled. This latter consideration, moreover, is unaffected by paying the men for overtime, and thus removing their own grievance in the matter,—a system which is liable to great abuse, for it may induce an avaricious and unprincipled man to keep a train back in order to secure for himself some extra pay.

Many railway officials have testified to us that they have no difficulty in preserving strict discipline among their men. We regard the matter as of great importance in relation to our inquiry, and we are of opinion that a company which showed itself indifferent to it ought to receive no consideration. Nor do we fear that our proposal would lead to excessive litigation. It is probable that actions under the amended law would be rare, save under Lord Campbell's Act, or else for injuries so severe as to incapacitate the sufferer for railway employment; and we think it desirable and right that many such cases which cannot be dealt with at present, should be investigated by the civil courts. The change, moreover, commends itself as being upon the same lines as the statute just cited, the most successful and approved precedent for indirect legislation in the interests of public safety.

CHAPTER XVIII.

Automatic Couplings and Either-side Brakes.

In order to properly consider the question of casualties to servants as it has developed since the Royal Commission reported in 1875, the figures given in Table VII. are important.

TABLE VII.

Year.	Killed.	Injured.	No. of Servants exposed to danger.	Proportion of Accidents to number employed.	
				Killed.	Injured.
1877	592	1975			
1878	516	1822			
1879	432	1818			
1880	500	1933			
1881	490	2254			
1882	514	2403			
1883	516	2335			
1884	498	2179			
1885	423	2007			
1886	404	1913			
1887	409	1953			
1888	377	2081			
1889	413	2622	220,570	1 in 534	1 in 84
1890	460	2946			—
1891	517	2977			
1892	506	2803			
1893	436	2543			
1894	453	2637			
1895	422	2548	270,739	1 in 642	1 in 106
1896	430	3806			
1897	483	3964			
1898	474	4007	307,983	1 in 650	1 in 77
1899	488	4386			
1900	544	4362			
1901	483	4058	325,671	1 in 674	1 in 80
1902	431	3696			
1903	423	3613			
1904	395	3781	325,868	1 in 825	1 in 86
1905	381	3661			
1906	416	4191			
1907	433*	5560†	342,094	1 in 790	1 in 62

* 376 in 1908. † 4976 in 1908.

These refer to those killed and injured in accidents connected with the movements of trains other than in train accidents The number of servants exposed to danger is derived from triennial returns obtained, since 1895, by the Board of Trade, as to the number of brakesmen, capstanmen, carriage and wagon cleaners, carriage and wagon examiners, chain-boys, chockers, engine-cleaners, guards, engine-drivers, motormen, firemen, gatekeepers, greasers, guards, horse-shunters, inspectors, labourers, lampmen, loaders, number-takers, permanent-way men, pointsmen, porters, shunters, signal fitters and yardsmen.

The sudden increase in the number of injured persons in 1896 arose from a more methodical method of reporting adopted from the beginning of that year. The increase in the figures for the year 1907 is referred to in Chapter XIX.

The question of safety of railway employees attracted considerable attention in Parliament ten or twelve years ago. It will be remembered, by the way, that in the Act of 1889 it was proposed to secure powers to compulsorily adopt automatic couplings. In 1891-2 a Select Committee sat on the question of excessive hours of labour (see next Chapter) and some of the witnesses recommended that sub-inspectors be appointed in the Railway Department to look into the question, but the Committee reported that they were unable to approve of the proposals. On February 9th, 1893, Mr. Channing

asked Mr. Mundella a question as to the appointment of sub-inspectors, to which the right hon. gentleman replied that the matter was receiving careful consideration, and that it would assume a more practical form after the passing of the Bill dealing with the Hours of Labour of Railway Servants. On May 30th, 1893, Mr. Channing again asked a question, to which Mr. Mundella replied:— "The desirability of appointing sub-inspectors of railways has engaged my careful attention, but I am advised that the existing Railway Regulation Acts do not impose duties upon the Board which could be delegated to the sub-inspectors. When the Railway Servants (Hours of Labour) Bill is placed on the Statute Book I will have to reconsider the question." Twelve months afterwards —on May 28th, 1894—Mr. Thomas Burt informed Mr. Channing that it had been decided to appoint two practical railway men as sub-inspectors to inquire into accidents to railway servants.

In August, 1898, a return was presented to Parliament, on the motion of Mr. Maddison, as to the number of accidents which had occurred during shunting operations to employees on the railways of the United Kingdom during the ten years ending 1897, setting forth, in separate columns, the fatal and non-fatal accidents on each line, and distinguishing those resulting from coupling and uncoupling from other causes, and a "statement showing the

numbers of goods guards, brakesmen and shunters killed and injured in the ten years ending 1897, showing the proportion killed and injured to the numbers employed." The figures of these returns are summarised in Tables VIII. and IX.

TABLE VIII.

Year.	In coupling and uncoupling only.		In other accidents during shunting.	
	Killed.	Injured.	Killed.	Injured.
1888	15	258	84	1003
1889	19	295	108	1226
1890	16	324	113	1324
1891	24	267	136	1404
1892	19	305	139	1336
1893	11	286	114	1141
1894	23	298	113	1221
1895	16	331	94	1127
1896	18	488*	118	2060*
1897	19	492	78	1908

* Amended Returns now in operation.

The next item of interest, taken in chronological order, was the memorandum by Mr. (now Sir) Francis J. S. Hopwood—at that time head of the Railway Department of the Board of Trade—upon the use of Automatic Couplings, and based on inquiries made during a recent visit to America. The memorandum opens with a history of the development of the Automatic Coupling in that country, a question that first arose in a practical form in 1874. In 1880, the then President sent a message on the subject to Congress, in which he said that "it is a

TABLE IX.

Year	Goods Guards and Brakesmen.					Shunters.				
	Killed	Injured	Total No. Empl'ed	Proportion to Number employed		Killed	Injured	Total No. Empl'ed	Proportion to Number employed	
				Killed	Injured				Killed	Injured
1888	40	365	7407§	1 in 185§	1 in 20§	28	329	6261§	1 in 224§	1 in 19§
1889	51	427	10038	1 in 197	1 in 23	31	355	5922	1 in 191	1 in 17
1890	41	524	...	1 in 245‡	1 in 19‡	36	391	...	1 in 164‡	1 in 15‡
1891	56	528	...	1 in 179‡	1 in 19‡	37	400	...	1 in 160‡	1 in 15‡
1892	45	467	...	1 in 223‡	1 in 21‡	36	359	...	1 in 164‡	1 in 16‡
1893	39	473	...	1 in 257‡	1 in 21‡	33	336	..	1 in 179‡	1 in 17‡
1894	45	464	...	1 in 223‡	1 in 21‡	38	391	...	1 in 156‡	1 in 15‡
1895	35	487	11881	1 in 340	1 in 24	26	332	7092	1 in 273	1 in 21
1896	36	794‖	...	1 in 330†	1 in 15‖†	34	598‖	...	1 in 209†	1 in 12‖†
1897	45	779	...	1 in 264†	1 in 15†	35	585	...	1 in 203†	1 in 12†

§ Based on 1884 figures. ‡ Based on 1889 figures. † Based on 1895 figures.
‖ Amended returns in operation.

reproach to our civilization that any class of American workman should, in the pursuit of a necessary and useful vocation be subjected to a peril of life and limb as great as that of a soldier in time of war." Mr. Hopwood gives the following list of the casualties to employees on the railways of the United States for the year ending June 30th, 1890:—

	Killed	Injured
Coupling and uncoupling	369	7842
Falling from trains and engines ...	561	2348
Overhead obstructions	89	343
Collisions	235	1035
Derailments	150	720
Other train accidents	146	894
At highway crossings	22	32
At stations	98	691
Other causes	754	8250
Unclassified	27	236
TOTAL	2,451	22,396

and adds that the Safety Appliances Act, calling for automatic couplers and continuous brakes passed Congress in March, 1893.

The Memorandum concludes:—

Surely in the face of the large consideration which has been given to this subject in America, and to the success which has attended the efforts both of the railroads and the Legislature in that country, it is not too much to say that the onus rests very heavily upon our railway companies to show that it is impossible for them to discover and standardise for their use some form of coupler which will couple automatically and prevent the necessity of a man having to go between the trucks to couple and uncouple. I believe there is sufficient inventive genius at home to surmount the alleged difficulty of finding a suitable coupler, but if it should, unfor-

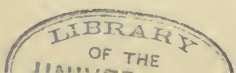
tunately, prove to be otherwise, I have good reason to believe that our American friends are quite ready to come over and help us.

The railway companies are entitled to reasonable time to find and apply a suitable coupler. It would, I apprehend, be of great assistance to them if the Board of Trade asked Parliament for legislative power to order the companies to apply a coupler in terms similar to that conferred upon the Department as to block-working, the interlocking of points and signals, and the use of continuous brakes by the Regulation of Railways Act, 1889. If Parliament conferred upon the Department permissive power to make such an order upon the companies, an incentive would be given to inventors and to the companies to carefully consider the subject with the object of coming to an early conclusion as to the best form of device for general application. Such a power would assist the companies in dealing with the private owners' wagons and would in the result conduce to facility in working and to minimise their liabilities under the Employers' Liability Act.

Some such incentive is absolutely necessary, or we shall be left behind. Interest in this subject is not confined to America, although, no doubt, the States have pioneered the question. In Russia, for instance, experiments are being made with the intention of introducing an automatic coupling on the State railways, and in the British Colonies the matter has received active attention.

If the Board of Trade are given powers to press this question upon the attention of the directors of our great companies, I cannot but believe that the energy of their principal servants and the advice of their experts, will prove equal to the task of surmounting a difficulty which has been faced and defeated in America.

In May, 1899, a Royal Commission under the presidency of Lord James of Hereford, was



appointed to "inquire into the causes of the accidents, fatal and non-fatal, to servants of railway companies and truck owners." It sat during 18 days, and examined thirty witnesses. Three sub-committees were appointed from its members, to (1) consider and receive suggestions from the public and from inventors as to improved couplings for wagons and carriages; (2) consider the minor causes of accidents; (3) consider the powers of the Board of Trade or other public departments and the means of making and enforcing rules for the safety of railway servants. It was shown that during 1898 out of the 403,050 railway servants exposed to danger, 499 were killed and 12,378 injured. These figures cover every form of mishap, and they average 1.24 per thousand killed and 31 per thousand injured. The most dangerous avocations are goods-guards, brakesmen, platelayers and shunters, and the following table shows the casualties of these :—

	Number employ'd	In accidents to trains and by movements of vehicles only.			
		Killed		Injured	
		Number	No. per 1000 employed	Number	No. per 1000 employed
Goods-guards & Brakesmen	14,720	43	2·92	711	48
Platelayers	63,360	122	1·9	2c4	3·2
Shunters	9·244	47	5 08	616	66

After making a remark that the total number of fatal accidents for all grades was in 1872 three times as great as in 1898, the report

comes to the question of coupling and uncoupling. A note is made that the coupling pole was introduced in 1886 and on this it is observed :— "No doubt the use of the pole has lessened the risks incurred by railway servants, but it by no means represents a perfect method of coupling and uncoupling, and gives rise to considerable and regrettable risk to the men employed. In order to make use of it, men also in the night-time have to carry a lamp in one hand, necessarily are obliged to run by the side of a moving train and to find a fulcrum as best they can on which to rest the pole. The space in which the pole has to be used is often of a too restricted character. Under these circumstances, if a man over-reaches himself, or slips or catches his feet in any impediment, he is liable to sustain injuries of a very serious character. It has to be observed that the shunting pole can only be used with loose link couplings, but as a number of wagons in use on railways are fitted with stiff couplings it is necessary for the men when coupling or uncoupling such wagons to pass between them and use their hands for the purpose of doing the work." This leads to the observation that what was needed was an automatic coupling, but "Mr. Hopwood, the representative of the Board of Trade, who has devoted great attention to the subject, in giving evidence before us, stated that he was not prepared to recommend any automatic coupling for general use, and no wit-

ness who gave evidence before us was so prepared." A *resumé* of the history of automatic couplings in America is given, and it is remarked:—"But the successful employment of automatic couplings in America does not necessarily establish that such couplings can be adapted to the wagons in use in this country. It was stated in evidence that in the former country the curves are not so numerous or so sharp as they are in the shunting yards of the United Kingdom. The wagons employed in the United States vary from 30 to 50 tons of carrying capacity, whilst that of our wagons rarely exceeds 10 tons. The large long wagons of the United States run upon two moveable trucks or bogies, each with four wheels, whilst the wagons used in this country run upon four wheels with a rigid wheel base. The American type of coupling has less elasticity or play than the standard draw-gear in use in this country, and it would appear that the want of play in combination with the rigid wheel base of the English vehicles might be prejudicial when trains are running over sharp curves where the changes are abrupt. Such curves for the most part exist in shunting yards. Moreover, the American type of coupling is unsuited to work in combination with the English draw-gear and side buffers, and this unsuitability would entail much difficulty during the period of transition necessary to complete the change from one system of coupling to another." After saying that their own sub-com-

mittee had received 184 communications, formed of drawings, photographs and descriptions in reference to automatic couplings, and remarking that "the existence of these necessary qualifications (i.e. what an automatic coupling must do) cannot be ascertained from the contents of specifications or drawings or from the inspection of models," the report says :—

The information before us causes us strongly to recommend that railway companies should either voluntarily or by obligation placed upon them, proceed forthwith to make these practical experiments which we have pointed out ought necessarily to precede the general application of any system of automatic couplings. We also recommend that the Board of Trade should be empowered to appoint a Departmental Committee to co-operate with the railway companies when making such experiments, and to consider the results of them when made.

The report then proceeds :—

We also desire to suggest that if it should be made obligatory upon railway companies to effect any important change in the system of couplings in use, care must be taken that such change should be carried out under conditions that shall not materially interfere with the trade of the country. All commercial industries will suffer if such be the case. The operation of transition from one system to another will take time to effect, during which the practical difficulty of wagons fitted with different kinds of couplings having to interlock with one another will have to be dealt with. Certainly a fully reasonable time for effecting such transition ought to be allowed.

In addition to shunting operations, and the dealing with railway vehicles in motion, there are many causes of accident which were brought to our

notice and which require serious consideration; thus, the passing of men between vehicles on the line for any purpose must to some extent be a source of danger. Obstacles on a railway, such as wires and lever-rods, over which men may fall, are complained of. Some stations and sidings are alleged to be badly and insufficiently lighted, and, in addition, there are several other causes of accident which ought to be removed. To effect this result we think the following suggestions should be carried out:—

1. Brake levers to be fixed on both sides of the wagons.

2. Similar labels showing the destination of the wagons to be placed on both sides of them.

3. Abolition of propping and tow-roping as far as possible.

4. That there shall be air or steam brakes on all engines.

5. That all stations or sidings where shunting operations are frequently carried on after dark shall be well and sufficiently lighted.

6. That where point-rods and signal-wires run across the ground in places where men engaged in shunting operations have to walk and work, such rods and wires shall be sufficiently covered over or protected. And that where points are worked by ground levers such levers shall fall parallel to the lines of rails.

7. That offices, cabins, etc., should as far as practicable be so arranged as to diminish the necessity for railway servants to walk upon the line.

8. That there shall be small marks provided to show "the fouling-points" for sidings.

9. That the gauge-glasses shall be so constructed or protected as not when breaking to be a danger to the men.

10. That the arrangements for carrying tool-boxes, etc., and the placing of the water-gauges

shall be such that the men shall not have to pass over the back of the tender whilst the engine is running.

11. That the trains shall not be run upon running lines beyond the limits of stations or shunting sidings without a brake van being provided for the guard in charge to ride in.

12. That mechanical means or look-out men shall be employed to protect gangs of men when engaged in relaying the permanent way. That such means shall also be employed when necessary to protect men engaged in repairing the permanent way.

Having carefully considered the facts and figures above set out, we have come to the conclusion that the deaths occurring and the injuries sustained amongst railway servants are unnecessarily great in number, and can, by means of authoritative action, be diminished.

If we are right in this conclusion we feel sure that every class of your Majesty's subjects will desire to see full and immediate action taken to diminish the preventible loss of life and injuries sustained by a deserving portion of the community.

At the same time, we feel that grave responsibility rests upon those who have to determine upon the remedies that should be applied to effect the desired result.

The saving of life and the avoidance of injury are difficult to weigh in comparison with other considerations. The representatives of railway companies and of the owners of wagons do not urge that financial questions should impede measures necessary to secure safety to their servants. But some regard must be had to the general interests of the country. A dislocation of traffic would be a very grave calamity, and therefore full consideration must be given to the methods of effecting the objects in view, so as to produce as little inconvenience as possible to the general trade which will be affected.

The Royal Commission then advance arguments to justify legislative interference with labour on railways on the grounds of its dangers —such interference having been made in the case of shipping, mining, factories, etc., and having satisfied themselves of the need for action they ask if there were any grounds upon which railway companies could claim exemption. They say:—

Railway undertakings enjoy special privileges conferred upon them by the State. Amongst others, power is granted to them in their inception to take lands compulsorily, of making, subject to the approval of the Board of Trade, bye-laws of a very extensive character, even affecting the public. Breaches of contract with them, offences against their bye-laws, and even in some cases trespass against their property and premises, are constituted offences. Their liability as carriers is limited, and they possess special powers with regard to tolls. Companies that receive so many benefits from State interference will find it difficult to demonstrate that they ought to be exempted from it.

On the other hand, the State already exercises large control over the railway companies, either directly by statute or indirectly through the delegated authority of the Board of Trade and the Railway and Canal Commissioners. Directly by statute the State limits the speed of trains over level crossings, and fixes maximum tolls, rates, and terminal charges. To the Board of Trade the State has assigned the inspection of passenger lines, and power to postpone their opening when unfit for traffic, and to regulate the method of their construction, power to deal with level crossings and gates, power to settle the form in which

accounts shall be kept, power to call for returns of accidents, and to appoint inspectors to inquire into them, power to order railway companies to adopt the block system of signalling, to interlock points and signals and to provide continuous brakes, power to order railway companies to provide cheap or workmen's trains, power to inquire into alleged overwork of railway servants, to direct the companies to submit revised schedules of hours of work, and to make returns of overtime.

It appears to us that any positive obligation of action upon railway companies can only be imposed in one of two ways, either by detailed enactment in a statute, or by giving statutory power to a Department of State to make regulations dealing with each danger as it presents itself, and to repeal or alter such regulations from time to time so as to fit the circumstances of each class of case. The first method appears to us objectionable, both on account of its want of elasticity and the great difficulty of imposing obligations that shall be applicable to all railways alike.

In the numerous instances given above the State is daily exercising its power of interference and control without any detriment to the interests of the railway companies. For instance, if when an accident has happened upon a railway it is right that an inspector should have power to enter upon the premises and inquire into the causes and circumstances of the accident, it seems difficult to suggest any objection to an inspection being made in order to prevent an accident occurring. We therefore think that the Legislature ought to invest a Department of State with certain powers for the inspection and regulation of the work done by shunters, goods guards, brakesmen, and platelayers. There appear to be some other employments and methods of railway working which may also be regarded as dangerous, and which should come within the above provisions. In determining the

extent to which powers should be vested in the State Department, we think great assistance may be derived from an examination of the powers which already exist and have been most beneficially exercised with regard to the great industries which are regarded as dangerous.

In the first place the Department should be enabled, from time to time, to determine what portions of railway working should be regarded as dangerous, and when such sections of railway working have been declared to be dangerous, the Department should have power conferred upon it to inspect such working and to make general rules, or give specific orders in the interests of safety. But we think that the two latter powers should be so exercised as not unduly to interfere with the necessary operations of railway companies, and that there should be an appeal as hereinafter mentioned against such general rules or specific orders when made.

The report concludes by recommending that within a certain period all wagons with "dead," i.e. non-spring, buffers should be withdrawn from traffic.

The result of the labours of the Royal Commission was the passage of the Railway Employment (Prevention of Accidents)Act, 1900—63 & 64 Vict., Ch. 27.

This empowers the Board of Trade to make rules as to dangerous railway operations. They may require "the use of any plant or appliance which has been shown to the satisfaction of the Board of Trade to be calculated to reduce danger to persons employed on a railway or the disuse of any plant or appliance which has been similarly shown to involve such danger.

The Board of Trade must give public notice of all rules that are proposed; they shall consider any objection, and may modify any draft rule, or, if they think fit, withdraw it without prejudice to the power of making a new rule.

The party objecting may require the Board of Trade to refer the matter to the Railway and Canal Commissioners, who shall decide whether the proposed rule be reasonable. Both the Board of Trade and the Commissioners must have regard to the trade of the country and the necessary operations of any railway company. Or, if the objectors agree, the point may be sent to a referee for decision, such referee being appointed by the Board of Trade.

After any rule has been in operation for at least three months any person affected by a rule may appeal to the Board of Trade for it to be rescinded or varied. If the rule has been in force for eighteen months, and the Board of Trade decline to interfere with it, they shall, on application, refer it to the Railway and Canal Commissioners.

The penalty for acting in contravention of, or failing to comply with, any rule shall be a fine not exceeding fifty pounds, or in the case of a continuing offence, to a fine not exceeding ten pounds for every day during which the offence continues after conviction.

The powers of the Board of Trade as to the inspections of railways were enlarged so as to include power "to inspect any railway for the

purpose of ascertaining where there is any ground for proceeding under this Act or whether there has been any contravention of or default in compliance with any rule made under this Act."

Railway companies are to report accidents to their servants that occur on private sidings, and the occupiers of factories and workshops where there is a siding must report accidents to the Secretary of State.

The issue of debenture stock to meet expenditure incurred under the Act is allowed by the Act upon a certificate from the Board of Trade.

Additional staff to carry the Act into effect, to hold inquiries and make experiments may be employed by the Board of Trade with the concurrence of the Treasury.

Sub-section 3 of Section 3 provides that "it shall be the duty of every railway company to give all reasonable facilities (subject to the due working of their traffic) for conducting any experiments made by the Board of Trade for the purpose of this Act, but such experiments shall be made without risk or expense to the railway company except as may be agreed, and except in case of default on the part of the railway company making the experiments."

The subjects for which rules may be made are given as follows in the schedule to the Act:—

1. Brake levers on both sides of wagons.
2. Labelling wagons.
3. Movement of wagons by propping and tow-roping.

4. Steam or other power brakes on engines.
5. Lighting of stations or sidings where shunting operations are frequently carried on after dark.
6. Protection of point rods and signal wires and position of ground levers working points.
7. Positions of offices and cabins near working lines.
8. Marking of fouling points.
9. Construction and protection of gauge glasses.
10. Arrangement of tool-boxes and water gauges on engines.
11. Working of trains without brake-vans upon running lines beyond the limits of stations.
12. Protection to permanent-way men when relaying or repairing permanent way.

On August 8th, 1902, the following rules—The Prevention of Accidents Rules—were brought into use:—

1. When it is necessary in the ordinary course of business that any label or direction as to destination or consignee shall be placed upon any wagon, the Company on whose line of railway such wagon is about to be used shall see that such label or direction is placed on both sides of such wagon. No railway company shall receive from any person for conveyance on its railway any wagon not labelled in accordance with this rule.

This rule shall not apply to mineral traffic in train loads for journeys not involving marshalling during or on the completion of the journey.

2. After the expiration of twelve months from the coming into operation of these rules, the movement of vehicles by means of a prop or pole, being the operation commonly known as "propping," shall not take place, except in cases where no other reasonably practicable means can be provided for dealing with the traffic.

After the expiration of the same period, tow-roping, that is to say, the effecting the movement of vehicles on a railway by means of towing with a rope or chain, attached to a locomotive, or a vehicle moving on an adjacent line, shall not be allowed, except in cases where no other reasonably practicable means can be provided for dealing with the traffic.

The North Wales Narrow Gauge Railway Company is exempted from the operation of this rule so far as relates to tow-roping.

3. All engines and tenders must, within two years from the coming into operation of these rules, be fitted with sufficient power brakes, in addition to hand brakes.

Engines used exclusively for shunting purposes shall be exempted from the operation of this rule, provided that they are fitted with sufficiently powerful hand brakes.

4. All stations or sidings where shunting operations are frequently carried on after dark must be sufficiently lighted.

5. Where point rods and signal wires are in such position as to be a source of danger to persons employed on a railway whilst in the execution of their duty, such point rods and signal wires must, within two years from the coming into operation of these rules, be sufficiently covered or otherwise guarded.

Within the same period ground levers working points must be so placed that men when working them are clear of adjacent lines, and shall be placed in a position parallel to the adjacent lines,

or in such other position and be of such form, as to cause as little obstruction as possible to persons employed on the railway whilst in the execution of their duty.

All boiler gauge glasses on locomotive engines or on stationary steam boilers used in the working of railways must, within three years from the coming into operation of these rules, be protected by a covering or guard sufficient to guard against accident to persons employed on the railway through the gauge glasses breaking.

7. All tool boxes used for the purpose of storing tools and other things, necessary in the working of locomotives when running, must, within two years from the coming into operation of these rules, be so arranged that the contents may be obtained by the men while the engine is in motion without undue risk of injury.

Water gauges or similar devices must, within three years from the coming into operation of these rules, be provided on locomotive engines or tenders to indicate the amount of water in the tanks, and such gauges and similar devices shall be placed in such a position as to be visible and accessible to the men without their incurring undue risk of injury.

8. After the coming into operation of these rules, all trains working upon running lines beyond the limits of stations shall be provided with brake vans or other suitable vehicles for the use of the men in charge of such trains, which shall be so attached as to be conveniently used by them, and also with due regard to safety in working the trains.

The Festiniog Railway Company is exempted from the operation of this rule.

9. With the object of protecting men working singly or in gangs on or near lines of railway in use for traffic for the purpose of relaying or repairing the permanent way of such lines, the railway companies shall, after the coming into operation of

these rules, in all cases where any danger is likely to arise, provide persons or apparatus for the purpose of maintaining a good look-out or for giving warning against any train or engine approaching such men so working, and the persons employed for such purpose shall be expressly instructed to act for such purpose, and shall be provided with all appliances necessary to give effect to such look-out.

10. In any case where it is shown to the Board of Trade that for any sufficient cause the time within which any of the above rules or regulations have to be carried into effect should be extended, the Board of Trade may from time to time grant such extension upon such terms and conditions as they may think fit.

These rules shall commence and come into operation on the 8th day of August, 1902, and may be cited as the Prevention of Accidents Rules, 1902.

It may be remarked that as sanctioned by section 15 of the Act of 1900, two assistant inspecting officers—Mr. Scott Main and Mr. J. H. Armytage—both practical men, were appointed to the Railway Department to inquire into the more serious accidents to employees.

The next point to be noticed was the appointment on April 28th, 1906, of a Departmental Committee (1) to examine, and if necessary to test, appliances designed to diminish danger to men employed in railway service; (2) to make, with the co-operation of the railway companies, such experiments as the Committee think expedient for the purpose under section 15 of the Railway Employment (Prevention of Accidents) Act, 1900; (3) to report to the Board of Trade

(a) at intervals of not more than six months what appliances have been considered and dealt with, and with what results; and (b) from time to time whether, in the opinion of the Committee, rules should be made under the Act of 1900 either (1) prescribing, or (2) prohibiting the use of appliances of a specified type, and if so, what interval, if any, might reasonably be allowed before such rules come into operation. The Committee consisted of Lt.-Col. Yorke, R.E., C.B., Chief Inspecting Officer of Railways, Mr. Richard Bell, M.P., Secretary to the Amalgamated Society of Railway Servants, and Mr. Robert Turnbull, Superintendent of the Line, L. & North-Western R. Mr. Scott Main, Assistant Inspecting Officer of Railways, was appointed Secretary to the Committee, which was entitled "The Railway Employment Safety Appliances Committee."

The first point the Committee decided that they would deal with was that of either-side brakes. The following general conditions were drafted and issued to the public:—

(1) The brake to be capable of being applied or released from either side of the wagon.

(2) The levers to be of similar pattern on both sides of the wagon, and the method of operating both levers to be identical.

(3) The levers to have a "press-down" and "lift-up" motion for operating the brake, with a "stop" or "rest" for each lever when in the "off" position.

(4) The levers to be capable of being operated by one hand.

(5) The levers to be "cross-cornered" and to the right of a man when facing the wagon side.

(6) The levers to clearly indicate on either side whether the brake is "on" or "off."

(7) The brake to be capable of being fitted to wagons with bottom doors.

(8) The lever handles to be not less than 3ft. and not more than 3ft. 6in. from the rail level in the "off" position, and not less than 12in. from the same level when applied to the fullest extent.

(9) The levers to be securely held or locked so as not to jar "off" or "on" by vibration or impact.

(10) The levers not to extend more than 6in. beyond the headstock of the wagon, and the leverage to have a ratio of not less than 22 to 1.

(11) The Committee will require to be satisfied that the brake can be made applicable to wagons fitted with automatic continuous brakes, utilising the same brake blocks.

The first report of the Committee is dated November 12th, 1906, but it was only a progress report. On May 28th, 1907, the second report was presented. The Committee reported that they had visited Willesden sidings by night in order to make themselves thoroughly acquainted with the manner in which the work is performed in the dark, and the features which a brake should possess under such conditions. There had up to the date of the report been five examinations of full-sized brakes—made during the day—and seven brakes tested, but none met with approval. Many of the brakes submitted had complied with the requirements already noted, but they were so complicated and bulky or comprised so many parts, that they were at

once disqualified. Others, again, were rejected because it was evident that they were too delicate or "tricky" for the rough usage inseparable from railway work in shunting yards. The report observes:—"It has ever to be borne in mind that brakes on goods wagons do not, and perhaps cannot receive such careful attention as those on passenger stock, and this is especially the case with wagons belonging to private traders."

Clause 3 of the conditions required that the brakes must be operated by a lever with an up and down movement, with a sufficient stop or rest when the brake is off. There are two reasons for the latter requirement. One is to hold the break off, and the other is to meet the practice of the men who have been accustomed to place their feet upon the brake-lever when climbing up the side of a wagon for any purpose. The report says:—"It may be said that the brake lever is not intended for this purpose, and that as the men have no right so to use it, they are not entitled to protection. But we feel that we have to take facts as we find them, and as we are sure that it would be impossible to prevent men from standing on brake-levers so long as these are placed in their present position, we have been forced to the conclusion that the condition as to the provision of a stop or rest for the side lever in the "off" position cannot be relaxed. It is, however, in this particular that the principal difficulty has arisen, and the

majority of the designs submitted to us have failed."

The trouble arose from the fact that the movement of the two levers had to be identical in every respect, "and the mechanism communicating the motion of one lever to the other must be of the most accurate description." A man operating the lever on one side frequently could not free the lever on the other. He could see the position of the lever he was working, but not the other, and did not know what was wrong, and so the attempt to apply the brake had to be abandoned. This, once at Edge Hill, led to a wagon running away, coming into collision with another wagon, and being derailed. The shunter on that occasion had a narrow escape from serious injury. Some inventors sought to overcome this by using the lateral or side spring to force the levers off their stops or rests as soon as one of them was lifted off its seat. But it was soon seen that the shocks received in shunting operations caused the levers to jump off their rests and unnecessarily apply the brake. If this were reversed and the lateral spring used to keep the lever on the rest, the shunter had to use abnormal force to overcome the resistance of both levers.

Other devices in the shape of escapements were provided. These, whilst being exceedingly ingenious, are not suited to the rough handling inséparable from shunting operations. The moving parts are also of necessity light and

fragile, their action is liable to be interfered with by dirt, rust, snow and ice, and even though they may work satisfactorily when new and under favourable conditions, the Committee did not think that they are suitable for the wear and tear, rough usage and exposure of railway work. Springs were suggested by some, but these were considered unreliable. Counterweights, to neutralise the increased effort required to work an either-side brake, were proposed by some, but they added to the dead weight of the wagon and caused undesirable and unnecessary movements of the levers.

The report then observes:— "One of the features of the present side-lever brake is that it lends itself to the use of the brake-stick (coupling pole). When in use one end of the stick is inserted under the spring or some portion of the frame of the wagon and over the end of the brake-lever. The shunter or brakesman then, using the frame of the wagon as a fulcrum, presses down on the other end of the brake-stick, and so brings considerable additional pressure to bear on the lever. The brake-stick, in fact, forms, in conjunction with the brake-lever, a compound lever whereby the total leverage obtained is very largely increased. Nothing approaching this leverage can be obtained with a simple side-lever without the brake-stick, and although it may be argued that it would be a good thing to abolish the brake-stick (the use of which is attended by certain disadvantages

such as the inconvenience of carrying it, and its liability to slip or break) there is nothing at present to take its place, and the men can hardly do without it. The only way to abolish the use of the brake-stick is to fit the brake permanently with a lever or system of levers giving a leverage of similar degree to that obtainable with the stick."

The Committee then point out that during the year 1905, there were two men killed and fifteen injured through the want of a lever to apply the brake from that side where the man happened to be, and three men injured through not being able to release the brake from the side opposite to that on which it had been applied. The corresponding figures for 1906 were two fatal and twenty non-fatal when applying and one fatal and four non-fatal when releasing, and these figures would appear to show, the Committee say, that the majority of accidents would be avoided if every wagon has a lever on each side by which a brake or brakes could be applied, even though it could only be released from that side on which it had been applied.

From enquiries made it would appear that there are about 750,000 railway-owned wagons, and about 650,000 privately-owned—a total of about 1,400,000. Many of these have what are known as single-ended brakes, and the objections to these are:— (1) that the men do not know at which end of the wagon the brake lever is, and (2) where two wagons come together

and the lever of the first is in the rear and that of the second is in the front, the interval of space, and—when the wagons are moving,—the interval of time are constantly varying.

The report concludes:—

We have now been engaged on the subject of either side brakes for twelve months. The most careful attention has been given to the question and exhaustive examinations of different appliances have been made. In all 51 designs in model and 69 full-size brakes (including 36 original designs and their subsequent modifications) have been inspected, examined and re-examined. Every opportunity has been given to inventors and also to the railway companies of the United Kingdom to submit brakes for our inspection, provided the designs were such as complied generally with the conditions which we considered essential for such appliances. The whole of the either-side brakes claiming to conform to those conditions may be said to have come under review, but in no instance has the appliance proved itself to possess sufficient merit to enable us to recommend that its general adoption be made compulsory. Moreover, the fact has impressed itself on us during the trials that all either-side brakes of whatever description, worked by levers acting simultaneously on both sides of a wagon, are open to the objection that injury may result to a man engaged on one side of the wagon by the movement of the lever made by another man in applying or releasing the brake from the opposite side of the wagon, each being in ignorance of the other's presence.

But having regard to the fact that the need of a brake capable of being applied from either side is greater than that of a brake which can be released from either side, we do not think that any further

delay should in the interests of the men be allowed to occur in the general adoption of a brake which can be *applied* from either side.

The Committee then recommended that certain rules should be adopted, and as a consequence the Board of Trade issued the following :—

The Board of Trade give notice, pursuant to Section 2 (1) of the Railway Employment (Prevention of Accidents) Act, that they propose to make a Rule with respect to the subject of brake levers on both sides of wagons, being the first of the matters specified in the Schedule to the above Act.

Copies of the draft Rule may be obtained at the Offices of the Board of Trade, 7, Whitehall Gardens, S.W.

Any objection or suggestion made with respect to the draft Rule by or on behalf of persons affected must be lodged with the Board of Trade.

The provisions of this proposed Rule are: (1) No wagon constructed after 3 months from the coming into operation of this rule shall be received into traffic unless it complies with Schedule I; (2) Within 7 years all wagons without brakes and with "one side" brakes shall comply with Schedule I; (3) Within 10 years all wagons with brake levers on both sides shall be "cross cornered" to comply with Schedule I; (4) Within 10 years all wagons must comply with Schedule I and hereafter no either-side wagon brake must be fitted unless it has been approved by the Board of Trade, except the wagons specified in Schedule II; (5) The Board of Trade may extend the times upon such terms and conditions as they think fit.

Schedule No. I.

1. The levers to be "cross cornered," and so placed that each lever will be to the right of a man facing the wagon side.

2. The levers to be of like pattern.

3. The levers to be capable of being operated by one hand.

4. The levers to be "press-down and lift up," and to be provided in the "off" position with a stop.

5. The handles of the levers to be not less than 3ft. and not more than 3ft. 6ins. from the rail level in the "off" position, and not less than 12ins. in the "on" position.

Schedule No. II.—Exemption from the Rule.

(*a*) Wagons used upon railways of a gauge less than 4ft. 8½ins.

(*b*) Chaldron wagons of a carrying capacity of 3 tons or less.

(*c*) Wagons of a carrying capacity of over 20 tons.

(*d*) Boiler wagons.

(*e*) Any other wagons, the special construction of which, in the opinion of the Board of Trade, renders compliance with this rule impracticable.

Provided that all wagons exempted under (*c*), (*d*), and (*e*) are fitted on both sides with such other appliances as will enable sufficient brake power to be conveniently applied from either side if, in the opinion of the Board of Trade, such other appliances are necessary.

These rules have not yet been adopted by the Board of Trade, owing principally to the opposition of the G.-Western R., who had equipped many wagons with a brake which, whilst not uniform with these requirements, could be released or applied from either side. The case was heard before the Railway Commission, who decided in favour of the Railway Company.

The third and fourth Reports of the Committee were issued in one White Paper (Cd. 4213) on August 14th, 1908.

The principal, most interesting, and far-reaching feature of these reports is a memorandum prepared by Colonel Yorke—the chairman of the committee—under date August 8th, 1907, addressed to the Assistant Secretary of the Railway Department on the subject of Automatic Couplings. It goes deeply into the reasons given by advocates of automatic couplings for their use in this country; the cause and the need for their introduction in America; a comparison as to the number of casualties in coupling and uncoupling on British and American railways; the vastness of the question in this country as to disturbance of traffic during the equipment of stock with automatic couplings; the cost; the length of time to do the work; the private owner. The Author will, however, briefly note Colonel Yorke's main points which, it must be admitted, at once effectively dispose of the question of automatic couplings for goods stock in the same way as the same committee's report just quoted disposed of that of either-side brakes.

The memorandum begins by observing that the necessity for making automatic couplings compulsory rests upon the assumption that the safety of the men would be largely increased by such appliances, but that this necessity is not so great as is generally imagined. The figures as to casualties in coupling and uncoupling vehicles for 1905 were 12 killed and 523 injured, and 9 killed and 572 injured during 1906. These figures compare with 18 killed and 481 injured during 1898—the year of the Royal Commission on Accidents to Railway Servants—and show a gratifying decrease in the number of fatal cases, and whilst the number of non-fatal cases have increased it must be remembered that more accurate returns are now rendered and that there has been a large increase in the

number of men employed, in the engines and vehicles used and in the traffic carried. The first point would then appear to be that there is not the necessity for automatic couplings in Great Britain that is generally imagined.

Point No. 2 is that automatic couplings, if introduced, will not remove all danger to men engaged in shunting. The uncoupling will still have to be done by hand by means of a lever or handle at the side, and therefore the men will continue to be amongst moving vehicles. They will also still have to go between the wagons to adjust the couplings, and, in fact, oftener than now, as vehicles will frequently automatically couple unnecessarily. Then there is the question of brake and steam-heating pipes, and as there is a gradual tendency to equip goods vehicles with continuous brake pipes this difficulty does not apply to passenger stock alone.

The next question dealt with by Colonel Yorke is the transition stage—a period that will vary in length according to whether automatic couplings are to be attached to all vehicles or only to new ones. If the latter, then the transition period will be a mighty long one, because, as the memorandum says, a wagon may be renewed and repaired from time to time, so that after a certain number of years nothing remains of the original wagon but the registration plate. But be the transition stage long or short it will bring a sheaf of troubles. There will be the delays due to joining up a wagon with a link coupling to one with an automatic coupling, and the danger to the men will be the greater during that time owing to the more frequent necessity for them to go between the wagons to adjust dissimilar couplings.

Colonel Yorke, at this point in the memorandum, returns to the question as to the need for automatic couplings, and shows that in America something had to be done. The link and pin coupler was what

was used there and it was necessary for a man to go between the cars whilst they were being brought together and to hold the link in one hand between the central buffers (into the jaws of which the link had to be guided) until these buffers were nearly in contact with each other, and then to snatch his hand away so as to avoid its being crushed, while with the other hand he dropped the pin into its place. Automatic couplings are now in universal use in America, yet during the year ending June 30th, 1905, there were 243 men killed and 3,110 injured, and 311 killed and 3,503 injured during the year ending June 1906. These compare with 12 killed and 523 injured during 1905 in Great Britain, and 9 killed and 572 injured during 1906.

Now we come to the question of cost. It has already been said that there are 750,000 wagons belonging to railway companies and 650,000 belonging to private owners—a total of 1,400,000, The number of passenger stock is 70,500. Here Colonel Yorke interjects figures to show that more accidents occur with passenger stock than with goods stock, as the former have screw couplings which compel a man to go between the carriages in order to tighten up or release the screw. With the 70,500 passenger vehicles there were in 1905 4 servants killed and 160 injured, and in 1906 4 killed and 241 injured. With twenty times as many goods wagons there were for the same years 8 killed and 349 injured, and 5 killed and 330 injured. The memorandum then explains that it is not the simple matter generally imagined to exchange an automatic coupling for an ordinary one, and it shows how the framework has to be reconstructed to withstand the shocks on a central buffer instead of along the side members. A good deal of time and money will therefore have to be spent upon every wagon in order to render it fit for automatic couplings. Couplings vary in price. Some being tried in India and the Colonies cost £15 per

wagon (£7 10s. per coupling) for standard gauge, and £12 for metre gauge, but this does not cover any strengthening of the wagon. Assume though, for the sake of argument, that £10 per wagon would cover everything, this would mean an expenditure of £14,000,000. Were this spread over a number of years this would not be so serious, but owing to the greater danger to the men it is desirable that the transition stage should be as brief as possible. Then look, too, at the cost to the trade of the country owing to the dislocation due to the wagons being withdrawn from traffic. If the work is to be done in ten years and each wagon takes two days to alter it would mean that 940 wagons per day for 10 years would have to be taken out of traffic. No wonder, then, that Colonel Yorke remarks "It would seem, then, that a dilemma is reached from which there is no escape."

Not the least of the problems is that next submitted,—How are the private owners to be compelled to undertake the expenditure necessary? The only way the Board of Trade can reach them at present is to prohibit railway companies after a certain date receiving wagons without automatic couplings. But supposing all the private owners were to agree amongst themselves not to adopt an automatic coupler, what then? The remedy is for the railways to buy up the stock, but this would entail a further large capital outlay. "Whatever the remedy may be, I have no doubt that if automatic couplings are ever to be introduced into this country, legislation of a drastic character will be necessary.

The main difficulty is, then, not a mechanical one, but a financial one, and so Colonel Yorke concludes his memorandum, "I feel sure that it is no use attempting to initiate experiments with automatic couplings till some practical scheme has been formulated for meeting the expense, not only of the ultimate change from one type of coupling

to another, but also of the trials and experiments which will have to be made. . . It would hardly be fair to encourage them (inventors) to come forward unless there was some reasonable prospect of the introduction of automatic couplers being carried through. The experiments themselves will cost a large sum of money, and will have to be extended over many years. Models will be of little use for the purpose, and even for the preliminary examination of any coupler it will be necessary for three or four wagons at least to be fitted with them. Such an examination will have regard to the mechanical features of the appliance, its weight, simplicity, certainty of action and ease of release. After weeding out those designs which are clearly unsuitable in any of the above respects there will remain others which will require a practical test in ordinary working. For this purpose it will be necessary for whole trains of not less than, say, 50 wagons each, to be equipped with the different couplings to be tried, and these trains will have to be put into traffic under the most unfavourable conditions in various parts of the country for at least twelve months in order that the reliability, strength, duration, safety, etc., etc., of the couplers may be investigated. . . I submit this memorandum for the consideration of the Board of Trade. From the remarks contained therein it will be gathered that the issues involved in, and the difficulties connected with, the proposal to render the introduction of automatic couplers compulsory in this country are almost insuperable. I do not think that their magnitude has hitherto been sufficiently appreciated. The question is of national importance, and it is, I submit, for the Government of the country to decide (1) Whether, having regard to the small number of accidents in this country due to the present method of coupling and uncoupling goods wagons, there is any such necessity for a change from the existing type of

coupler as to justify the large capital outlay and the dislocation of traffic, which would be inevitable. (2) How, if the change is decided upon, the enormous expenditure connected therewith is to be met. (3) How the owners of private wagons are to be dealt with. (4) How the dislocation of traffic and risk of accident to men and trains during the experimental and transition stages are to be faced. Until these questions have been considered and answered it will be inexpedient and useless to initiate a series of long and costly experiments for the purpose of selecting the automatic coupling best suited to English rolling stock."

This memorandum was referred to the Railway Employment Safety Appliances Committee, and they reported that they entirely agree with the remarks contained therein, but suggested that some effort be made whereby the three-link coupling could be put on and taken off the draw-bar hook by some other means than by the shunting pole. As a result of this the committee have received and examined twelve models designed to accomplish this object. It was generally found that these appliances fell under two headings, viz., those which retain and operate upon the existing three links, and those where one link or two links are substituted for the present wagon coupling, the draw-bar hook remaining unaltered. The committee were inclined to think that, at present, appliances of the former description are preferable to those of the latter.

CHAPTER XIX.

Accidents to Employees.

Returning now to a consideration of the figures in Table VII. (p. 167) as to the number of servants killed and injured by the movement of vehicles other than in train accidents. It should first be noted that in less than 20 years the number of servants exposed to danger has increased over 50 per cent., and that the total mileage in the same period has increased from 303 millions to 428 millions. As regards fatal accidents there is certainly not a proportionate increase. The figures for the year 1907 show 433 fatal cases, which, whilst higher than for the years 1902-1906, has rarely been bettered even although the number of men employed is higher now than in former years, and the mileage more. Some satisfaction may then be found in these figures, although it must be confessed that it is lamentable that the death-roll is as high as it is.

As to the non-fatal cases, the Author at once confesses that to him the returns give some uneasiness. The increase in the figures for 1896 over previous years has already been noted (p. 168) as being due to improved and standardised methods of reporting non-fatal cases. But a jump of more than 50 per cent.

over the figures for the years 1902-1905 requires some explaining away. Some explanation may be found in the fact that there is an increase of 16,226 or 5 per cent. in the number of servants exposed to danger during the last three years, and the mileage has increased from 397 millions to 428 millions, or 7 per cent. The greater part of the increase is no doubt due to a further amendment by the Board of Trade as to the reporting of non-fatal accidents. As the annual report for 1907 observes:—"Under the present system practically all the accidents previously reported are included, with the addition of those in which the injury only causes cessation of work after three days or more. It has also to be borne in mind that . . . a considerable number of accidents occurring in goods sheds and warehouses previously returned as Factory Accidents have been included in the Board of Trade returns for the past year." Experience in America during the period of depression that has prevailed since the summer of 1907 shows that fewer accidents occur during such times. There are not so many goods trains, the men are less "rushed," they work fewer hours, and the careless and indifferent are weeded out. This suggests the thought that during a "boom" there are more accidents, and as there was some pressure in this country during the latter part of 1906 and beginning of 1907 this along with the increase in staff, is the probable explanation for the increase of 530 in the

cases of injury in 1906 compared with 1905, and these, coupled with the amended returns, for the further increase of 1,369 in 1907 over the year 1906.

It will now be interesting to see how these casualties were caused. It has already been observed that two sub-inspecting officers were appointed in 1894 to inquire into accidents to employees. A third was appointed in 1905, and then there are the two assistant inspecting officers. These hold inquiries into all those accidents to servants which, when reported to the Board of Trade, suggest themselves as calling for inquiry, especially if they appear to indicate some neglect on the part of the railway company. During the year 1907, there were, as shown in Table VII., 5,993 casualties to employees, and in addition there were 25 accidents to contractors' servants—a total of 6,018 cases. Of these 841 were inquired into by the Board of Trade through the assisting inspecting officers or the sub-inspectors, and they are classified as shown in the first column of Table X., p. 207. The second column gives the causes as assigned by the railway company when reporting the accident.

The annual report observes that it is difficult to assign more than 240 of these cases to preventable causes and that the accidents under the first three headings, which may be described as unpreventable, outnumber the preventable by 24 to 1. In 1906 the proportion was 18 to 1.

TABLE X.	Inquired into.	Not Inquired into.	Total.
Misadventure or accidental	181	3621	3802
Want of caution or misconduct on the part of the injured person	375	1295	1670
Want of caution or breach of rules on the part of servants other than the injured person	153	153	306
Defective system of working, dangerous places and conditions of work, etc.	82	6	88
Defective apparatus, want of appliances or safe-guards, &c.	32	89	121
Neglect or non-observance of Rules under Railway Employment (Prevention of Accidents) Act, 1900 ...	18	13	31
TOTAL ...	841	5177	6018

In order to judge what are the conclusions generally arrived at by the inquiring officers it is necessary to consult the quarterly returns of accidents and casualties. At the time of writing, the last of these was for the three months ending December 1907. Taking the 43 cases inquired into by the assisting inspecting officers, which are, be it remembered, the more serious cases, we read:— "Signal left off by colliery staff; responsibility rests with injured man; carelessness of fellow-servant (dismissed); 'injured man forgot'; want of caution; coupling vehicles with gangway before vehicles had come to a stand, and contrary to rule; want of care; signal-fitter repairing apparatus had watchman out, but latter 'failed to notice the approach of

the Slough train'; misadventure; failure to exercise reasonable care; want of caution (two cases); proper steps not taken by ganger; want of caution on the part of man killed, but ganger not free from blame; want of caution; misadventure; want of care; want of caution; failure to exercise sufficient care; act of fellow-servant; error of judgment on part of foreman; misadventure (two cases)." The foregoing disposes of 28 of the 43 cases. The remaining fifteen are:—Seven surfacemen killed on the Glasgow & Paisley Joint Line owing to their not having acted up to Rule 273a, but the permanent way inspector had failed to satisfy himself that the men knew their rules; man injured at a lift through forgetfulness on his part, but the assisting inspecting officer in October 1906 had recommended an alteration to the lift which, if it had been carried out, would have prevented this accident; shunter killed through failing to exercise due care—the assisting inspecting officer calls attention to the narrow space between three adjoining shunting necks which should be ten feet instead of six feet, and to only one man being on the footplate of the small twenty-ton tank-engines used for shunting, and recommending that two men should be employed so that an efficient look-out may be kept; point-oiler killed—assisting inspecting officer says:—"Accidents of this nature are almost certain to occur if men of such limited experience are employed as point-oilers, and it is to be hoped

that the company will take steps to insure that only experienced men are employed upon this work in future"; two platelayers killed, and responsibility rests upon acting ganger but the assisting inspecting officer does not think that he appreciated his responsibility and that the company should take steps to ensure that no misunderstanding can occur on this point in future; examiner of electric car injured owing to breach of rule, but man in charge of depot admitted that rule had not been properly observed; platelayer had been on duty from 7 a.m. to 5 p.m., and was called out again at 8.45 p.m. to clear the snow from points, was found killed at 10.30 p.m., and it is suggested that he was not as alert as usual and should not have been engaged in such work without a look-out man; tow-roping and contrary to Prevention of Accidents Rules; labourer employed by some contractor killed owing to his want of experience—the assisting inspecting officer thinks that he should not have been so employed except under the immediate supervision and control of some person acquainted with the rules. Then come three reports of casualties to platelayers due in each case to lack of acquaintance with the rules, for which the gangers and inspectors are considered to blame. The remaining three cases are:—Look-out arrangements unsatisfactory; platelayers' lobby in an undesirable position; propping wagons contrary to Prevention of Accidents Rules.

This subject may be closed by some reference to coupling accidents. There were 581 such accidents during 1906 and 775 during 1907, and these are classified thus :—

	1906		1907	
	Killed	Injured	Killed	Injured
Coupling or uncoupling with pole	3	264	3	363
,, ,, without pole	2	66	7	96
,, ,, screw coupled vehicles ...	4	241	7	296
,, ,, with automatic couplings ...	—	1	1	2
TOTAL ...	9	572	18	757

The report for 1906 said that many of the accidents which occur in coupling with the pole are caused by attempting to couple while the vehicles are in motion. One railway company, it was stated, had already issued instructions that coupling by pole should be avoided until wagons have come together, and if such a rule were adopted generally, the number of accidents under this head would be naturally reduced. The report for 1907 said that the majority of the casualties with the coupling poles were due to the men attempting to couple the vehicles before they came together, but it is satisfactory to record that the majority of the larger companies have now adopted the Board's suggestion that the men should be warned against the practice. All the accidents where screw-coupled vehicles were concerned might have been avoided if the men had waited until the vehicles were at rest before attempting to go

between them. It is believed that their number would be materially reduced if the companies were to give instructions that men must not attempt to go into the "four-foot" to couple or uncouple whilst the vehicles are in motion.

CHAPTER XX.

Hours of Duty.

In Chapter X. this subject was dealt with in relation to earlier accidents. The events of recent years will now be noticed.

The question often cropped up in the Board of Trade reports where long hours either caused or contributed to accidents. As a result, the Board of Trade secured powers in the Act of 1889, section 4, to call for returns as to hours of duty. (See p. 101).

In November, 1890, the Board of Trade wrote the Associated Railway Companies on the matter, and Mr. Oakley replied, January, 1891. On February 3rd, 1891, a Select Committee of the House of Commons, under the chairmanship of Sir Michael Hicks-Beach, was appointed to inquire into the matter. They presented a progress report on July 16th, 1891, and on February 16th, 1892, were re-appointed. They reported in June, 1892, and commenced by remarking that they had been appointed immediately after the Scotch Railway Strike, when public attention had been called to the Hours of Duty. Excessive hours appeared most frequent on lines with a heavy goods and mineral traffic. The report refers to "the great improvement

which has been effected on the L. & North-Western, Great Western, Midland, North-Eastern and on other lines by a constant attention to the subject, by a large expenditure on new works to meet the increase of traffic, and by a carefully organised system of reliefs and the provision of comfortable accommodation for men when off duty and absent from home. There were still too many cases in which excessive hours are habitually worked without adequate reason, and that no sufficient effort has been made by the companies generally to deal earnestly and generally with the matter." Sir Francis Marindin, the then chief inspecting officer of railways, said that during the previous four years there had been 257 inquiries into railway accidents. In 47 of the reports mention was made of cases where long hours had been worked, in 17 the person to blame had been on duty an excessive time, and in 9 long hours were the actual cause. Reference is made in the report to a fogman on the L. Brighton & South Coast R., who was killed, and had been on duty 23½ hours, and to a goods guard on the Midland and South-Western Junction R., who was killed, and had been on duty 22 hours. The Select Committee recommended that 8 hours should be the maximum turn of duty for a signalman in a busy box and 10 hours elsewhere; that the Board of Trade should still call for returns; that they should investigate cases of apparent excessive

time, and that the Board of Trade should call on the companies to submit a satisfactory schedule. The responsibility for the preparation and administration of the schedule should be carefully confined to the railway companies. Some witnesses had recommended that sub-inspectors should be appointed, but the Committee were unable to approve of this proposal. Sub-inspectors were subsequently appointed, but for a different purpose as related in the last Chapter, p. 206.

On April 26th, 1892, Mr. Channing moved for a return of all instances since and including 1884, where Board of Trade reports on accidents have shown the hours of duty of men to have been unduly long. The report showed 68 cases in the 8 years.

In 1893 the Railway Regulation Act of 1893—56—7 Vic., Ch. 29—was passed, by which it is ordered that if it is represented to the Board of Trade by or on behalf of the servants or any class of servants that their hours of duty are excessive or do not provide sufficient intervals of uninterrupted rest between the periods of duty or sufficient relief as to Sunday duty, the Board of Trade shall inquire into such representations. If the Board of Trade see reasonable ground they shall call on the railway company to submit a schedule of time as will, in the opinion of the Board, bring the actual hours of work within reasonable limits, regard being had to all the circumstances of the traffic and to the nature of

the work. If the railway company fail to comply with the request of the Board of Trade the matter must be referred to the Railway & Canal Commission. The penalty for disobedience is £100 per diem. The Board of Trade and Railway Commission may rescind or vary any order or make supplemental orders.

In the first year that the Act was in force—year ending July, 1894—there were 72 complaints, and in the subsequent six years there were respectively 156, 97, 76, 50, 46 and 41. Up to July, 1895, there had been 766, and up to July, 1907, there had been 874 complaints. During the year ending July, 1905, there were 38 complaints affecting 47 men, or sets of men. The report said that in 28 of these cases some action had been taken either voluntarily or as a result of the representation of the Board of Trade whereby the conditions would be improved. In 7 cases the Board considered that there was no ground for complaint, whilst 3 of the cases were under inquiry.

The railway companies have a grievance against the Board of Trade as to how the annual returns are prepared. The Board say (1) the length of period of duty for the purposes of the return is to be reckoned as the total length of duty from start to finish, no deduction being made for any intervals of rest that may occur in the course of the period; (2) time occupied by men in travelling to and from their work is to be included in the length of the period of duty

provided that it will be considered and paid for as part of the day's work. But when trainmen are detained on the road and cannot reach their home within reasonable time they are relieved, and return home as passengers, and are paid for the time so spent as though they were at work. Mr. Inglis, of the Great Western R., in particular, has complained of this, as such figures are "calculated to the prejudice of the company by making it appear that overtime is worked upon the railway to a far greater extent than is actually the fact." The Board of Trade apparently admit the justice of the contention, as the circular letter asking for the return says that if the companies desire to submit supplemental information, the Board will consider whether such information can be included in the return as presented to Parliament. The effect of the modified return may be judged from the following figures of the Great Western R. for the month of March, 1905 :—

	No. of men employed	No. whose hours exceeded 12 per day on one or more occasions	No. of instances
As per Board of Trade specification ...	11964	4281	5688*
As amended by deducting time spent in travelling	11964	3783	2633†

* Equals about one instance during the month for every two men employed.

† Equals about one instance during the month for every four men employed.

During the temporary boom of the Spring and Summer of 1907, men were worked extra

hard, and the number of complaints was greatly increased. Reports on these were contained in the Annual Report for 1907. The contents of this may be judged from the following editorial in *The Engineer* of October 4th, 1907.

At the present moment the publication of the annual report of the Board of Trade on the working of the Railways Regulation Act is peculiarly opportune, dealing, as it does, with one of the matters concerning which the railway world is agitated. The report gives in some detail an account of the proceedings which the railway department of the Board of Trade has taken in investigating complaints made concerning the number of hours worked and the way in which they are spent, by men who feel that they have a grievance. The Board of Trade is empowered to inquire into all cases of the kind, and to make such orders as may seem proper. The Board communicates with railway companies upon the subject of the hours of labour of their servants, without in general making known the source of the representation upon which its action is founded. It is pleasant to add that "the Board has no reason to think that railway companies would visit displeasure upon servants who make representations to the Department, but the men are held to be entitled to an assurance that communications addressed to the Board will be treated as confidential, unless they are willing that the origin of their representations should be disclosed."

It is not easy to arrive at the total number of guards, drivers and firemen with whom the report deals. Possibly we shall not be far wrong if we take it at about 100,000. Then there are platelayers, gatemen, signalmen, etc. The Railways Regulation Act was passed in 1893, and, during the fourteen years that it has been in force only

874 complaints have reached the Board. This is an average of only 62.4 per year, quite a minute percentage of the number of men employed. Particulars are given of the hours worked on all the principal railway lines, and there is no reason to doubt that Lieut-Col. Druitt has taken great pains to get at the fact by personally interviewing the men affected. It must be understood that there are at least three definite influences at work. The men may object to long hours, the Board of Trade object in the interest of the public without regard to the wishes of the companies or of their servants; and the railway companies object because overtime is expensive and the efficiency of the men is reduced by fatigue. The regulation of working hours on railways is much more complex than appears on the surface. It is, for example, very easy to say that a driver and fireman must not work more than ten hours on end. If, however, when the time has expired, they find themselves in the country, far from any station, it is evident that they must remain on the footplate at work. Again, when we come to reckon up "hours employed," we have to consider what the words mean. For example, the standard number of hours per week is sixty. Col. Druitt investigated twenty-five cases on the Midland Railway, including nineteen cases of the longest periods known. Of these twenty-five turns, the average length was 17 hours 20 minutes; but the time spent travelling home after relief averaged 2 hours 54 minutes, and the actual time in charge of the train 14 hours 26 minutes. Col. Druitt points out further that an examination of the guards' journals will show that a large proportion of the time "in charge" was occupied by standing either at signals or behind other trains. These stoppages vary from a few minutes to as much as 5 hours 55 minutes. During such periods of waiting the duties of the men consist in protecting the rear of their trains, if no train is standing behind

them, in going to the signal-box if need be, and in general supervision of their trains. Such delays must be tedious and irksome, but the strain on the men's attention and faculties must be considerably less than when trains are travelling or shunting work is going on. Indeed, there is no particular reason why a part of the time should not be spent in sleep. It must be kept carefully in mind that all these cases refer to mineral, goods, and "pick-up" goods trains. They have nothing to do with passenger traffic. Taking drivers and firemen, the longest case, 19 hours 20 minutes, may be regarded as typical. Of this 4 hours and 45 minutes were expended in waiting and travelling after relief, in working the train only 6 hours and 5 minutes, and in standing in sidings, etc., 8 hours 20 minutes. Of thirty-three cases investigated the excessive hours were due in three cases to what may be termed exceptional causes, such as relaying, single-line working, etc.; in two cases—partly—also to an exceptional cause—foggy weather; in twenty-eight cases mainly to congestion of traffic and failure to supply relief.

It would occupy more space than we can spare to explain in actual detail all the reasons that lead to the prolongation of working hours. Mainly it is due to the want of punctuality in the running of goods and mineral trains, and that is brought about by causes over which the companies really appear to have no control. The men are expected to telegraph when they want relief, but it is not always easy to supply it. Thus there may be no passenger trains running at night to convey the relief; or an error may be made by the train men, and they may arrive and pass the station at which the relief should be before its arrival, or not get there until hours afterwards. All things considered, it seems remarkable that the number of complaints should be so small; and Colonel Druitt is prompt to admit that the railway companies appear to leave no effort

untried to keep down hours to sixty a week. Furthermore, it must not be forgotten that the men are by no means unanimous in their desire to avoid long hours and overtime pay. Thus we are told that they do not object greatly to spending a considerable time in travelling home after relief, and prefer thereby to increase their time on duty and to diminish their actual hours of rest rather than lodge out. Lodging-money is always allowed.

Still confining our attention to the Midland Railway, for what is true of it is in the main true of all the other railways, we find that last year most of the trouble was due to the development of trade, particularly in coal and iron. The root cause of the excessive hours was the delays to goods and mineral trains. The booked timings were completely disorganised by the trains being held up, and forced to stand at long intervals, one behind another on running goods lines. Cases of excessive hours would have been of rare occurrence if the trains had been able to work to the timings. The blocks and stoppings were caused mainly by the congested state of the various marshalling yards, sorting depôts, and reception sidings. Coal depôts such as Toton, Clay Cross (Avenue), Wincobank and Carlton were not able to deal quickly enough with the traffic poured into them. Fogs played their pernicious part. During the first three months of 1907 the wages of fogmen were three times as great as they were during the first three months of 1906. The mineral traffic to sea ports, e.g., Hull, was so great, and the consumption by the large iron and steel manufacturers of Sheffield so exceptional, that the consumers were not able to take over traffic handed to them. The late arrival of steamships, and the consequent inability of other railway companies to receive traffic that had been ordered, blocked the depôts and reception lines, and often necessitated the conversion of running goods lines into sidings.

It is by no means easy to suggest an efficient and satisfactory remedy. The provision of more men can have little effect. If a man lives, let us say, in Rugby, and getting off the footplate at Chalk Farm after a ten hours' day, insists on returning to Rugby the same night, he adds, say, three hours to his working day, for which he is paid at ordinary rates. But it seems scarcely fair to call this a working day of thirteen hours. The men apparently understand the position quite well, and appreciate the difficulty of introducing improvements. So far as can be gathered, they would, in the main, be content if they were allowed a clear ten hours off duty between any two terms on duty. The companies seem to be just as anxious to give this time as the men are to take it. Of Colonel Druitt's absolute impartiality there can be no doubt. The story he has to tell should be carefully mastered by everyone who is interested in disputes between railway companies and their men, because it is only from documents of the kind that the accurate information can be obtained which is essential to the formation of a sound opinion about the questions discussed.

CHAPTER XXI.

American Railway Accidents.

It is desirable that some record should be made of the number of accidents on the railways of the United States. The figures as to these are made available by the quarterly bulletins of the Inter-State Commerce Commission, that for the quarter ending June giving also the returns for the year. These are given again, but in a more accurate form, together with all kinds of information as to American railways in the annual reports of the Inter-State Commerce Commission.

The figures for the last six years are shown the Table X, the year ends June 30th. It is argued by American railway officials that the amount of their freight traffic is the cause for so many disasters. This is due to the fact that not so much care is exercised over goods trains as over passenger, and their running is not only more irregular but very haphazard. Freight trains are liable to break in two and cause collisions, and get derailed often. An increase in freight traffic leads to delay, longer hours, and consequently greater demands on the bodily and mental faculties of the employees.

TABLE X.

	1902	1903	1904	1905	1906	1907
No of passengers carried	649 Millions.	694 Millions.	715 Millions.	738 Millions.	799 Millions.	874 Millions.
Tons of freight carried	1200 Millions.	1304 Millions.	1309 Millions.	1427 Millions.	1631 Millions.	1796 Millions.
Collisions	5042	6167	6436	6224	7194	8026
Derailments	3633	4476	4855	5371	6261	7432
Passengers in train accidents { Killed	167	164	270	350	182	410
Passengers in train accidents { Injured	3586	4424	4945	6498	6778	9070
Servants in train accidents { Killed	697	895	844	798	879	1011
Servants in train accidents { Injured	5046	6440	6990	7052	7483	8924
Passengers by movement of vehicles other than in train accidents { Killed ...	136	157	150	187	236	237
Passengers by movement of vehicles other than in train accidents { Injured	2503	2549	3132	3542	4707	4527
Servants by movement of vehicles other than in train accidents { Killed ...	1819	2338	2523	2463	2928	3342
Servants by movement of vehicles other than in train accidents { Injurep ...	27665	32564	36276	38374	48041	53765
Average casualties to passengers to total number carried, 1 in every ... ... } Killed ...	1·88 Millions.	1·95 Millions.	1·62 Millions.	1·37 Millions.	2·22 Millions.	1·43 Millions.
Average casualties to passengers to total number carried, 1 in every ... ... } Injured ...	·097 Millions.	·084 Millions.	·078 Millions.	·070 Millions.	·074 Millions.	·067 Millions.
Average casualties to servants to number of men on pay roll, 1 in every ... ... } Killed ...	401	364	357	411	387	369
Average casualties to servants to number of men on pay roll, 1 in every ... ... } Injured ...	24	22	19	21	20	19

TABLE XI.

	1902	1903	1904	1905	1906	1907
	Million Tons	Million Tons	Million Tons	Million Tons	Million Tons	Million Tons
Average number of collisions and derailments to tons of freight carried, 1 to every	·138	·122	·115	·123	·121	·106
Average uumber of passengers killed in train accidents to tons of freight carried, 1 to every...	7·185	7·951	4·845	4·077	9·511	4·390
Average number of passengers injured in train accidents to tons of freight carried, 1 to every	·334	·290	·262	·219	·242	·198
Average number of servants killed to tons of freight carried, 1 to every	·476	·403	·391	·437	·428	·413
Average number of servants injured to tons of freight carried, 1 to every	·035	·033	·030	·031	·029	·027

That the amount of freight traffic has an effect on the safety of travel is shown by the figures for the year ending June, 1908. Only 165 passengers were killed, and here will be seen the result of the depression that has prevailed since the Autumn of 1907. Not only has traffic been less, but there has been less demand on the men, and the indifferent ones have, no doubt, been weeded out.

The Author is inclined to think that there is more in the last-named suggestion—the weeding out of the careless ones—than is generally conceded. If the figures in Table XI. are looked at it will be observed that the number of collisions and derailments and, consequently, casualties to passengers and employees, has grown faster than the amount of freight traffic, which would appear to show that there has been a general growth of carelessness, and possibly of indifference.

Each Bulletin of the Inter-State Commerce Commission provides some food for reflection, Item 15 in Bulletin No. 7 shows 23 killed and 85 injured in the Westfield N.J. collision, where an express driver ignored several automatic signals and ran into another train. Item 34 in the same bulletin refers to an operator who, knowing the name of the conductor of an approaching train, accepted two orders in his name and secured the train dispatcher's "complete" before the train arrived. The operator went out of the office and left the orders for

the conductor on his counter. The conductor claims that he only found one order, and on this he acted, with the result that a collision occurred causing 8 deaths and injury to 30. The rule not only requires that the conductor read his order aloud to the operator for comparison, but also prohibits conductors from tearing off orders in the absence of the operator. Item 33 in Bulletin No. 8—3 killed and 7 injured—says:—"Passenger train was several hours late; conductor and enginemen of switching crew that had been working in a rolling mill all day, entered main line at 7 p.m. without examining register; engineman 'thought' he had heard the passenger train pass." Item 24 in Bulletin No. 9, where 22 were killed, says:—"Conductor of freight misread telegraphic order, it read 20 minutes, he read it 1 hour and 20 minutes. Engineman took conductor's word and did not read order." The quarter ending December, 1903, covered by Bulletin No. 10, was a very bad one. No less than 147 passengers were killed in train accidents. One derailment accounted for 65 deaths. This was due to a passenger train running into a load of timber that had fallen off a passing goods train. Only on four occasions had there been railway accidents in which more lives were lost. A collision—No. 6 in this bulletin—caused 32 deaths owing to the flagman, no doubt relying on the good view obtained by following trains, omitted to go back to protect his train,

and the engineman of the following train omitted to keep a look-out. Sixteen deaths were also caused by a work-train occupying the main line for a longer time than the train-dispatcher had sanctioned. Bulletin No. 11 produces many samples of the evils under which most American single lines are worked. These are a selection from this particular bulletin:—"Conductor neglected to deliver meeting order to engineman." "Operator, 8 months' experience, failed to deliver order." "Operator failed to notify southbound train that a northbound train, first section, had brought to that point signals for a second section." "Operator signed a conductor's name to order, but then failed to deliver it; expected conductor to come into office for clearance-card, but conductor neglected this duty, both experienced men." "Engineman of northbound train neglected to examine register, and so was ignorant of non-arrival of southbound train. Engineman depended on conductor to check southbound train, but conductor failed to check correctly." "Northbound passenger ordered to wait for 4 southbound freights; waited only for 3; operator also at fault for clearing signal." "Passenger train passed a meeting station without stopping, conductor and engineman did not correctly identify freight met at station," (18 killed in this collision). Nothing of note is recorded in Bulletin No. 12 unless it be noteworthy, and surely it is, that only 23 passengers

were killed in train accidents in that quarter—April to June, 1904. This becomes the more noticeable when Bulletin No. 13 for the next quarter is dealt with. The number of passengers killed was 228, of which 217 lost their lives in 6 accidents. In one case 88 lives were lost owing to a bridge giving way owing to being knocked down by floating wreckage caused by a sudden waterspout. The Bulletin says of this:—"From the conclusions of the Coroner's Jury which investigated the case, there would appear to be reason for making a thorough inquiry not only into the circumstances attending the accident, but also into the design and construction of the bridge, and even the surveys and plans which were made to decide the location of the road and its elevation above the surrounding lands and streams." One collision accounted for 63 lives and was due to the conductor and engineman of a westbound train forgetting a meeting order given them only 35 minutes before. Bulletin No. 14 furnishes a case where a signalman had only been in the service for three days, and yet was entrusted with the management at night of a grade crossing where two lines crossed each other. During the three months ending June, 1905 there were three accidents on note. One was at Harrisburg on the Pennsylvania, where 23 lives were lost. It was caused through a westbound express running into a freight train that had broken down, and in which

was a car of explosives, which exploded. The International Railway Congress was meeting in Washington at the time, and a vote of condolence was passed on the initiative of the British representatives. The next was the Mentor wreck, when the Twentieth Century express from Chicago to New York, via the Lake Shore route, was turned into a siding and wrecked—19 deaths. This accident has an interest to the Author. He was in Cleveland the previous day and was introduced to a fellow-Englishman who was killed in the accident. The Author went through Mentor 24 hours before the wreck, and at the time he heard of it he was putting in 36 hours on the Lehigh Valley R.R., due to being hung up owing to washout. The accident at Mentor was never accounted for. Probably it was caused maliciously. It only need be said here that had the points been coupled to a signal box and running signals provided, it could hardly have happened. The third accident—a collision causing 26 deaths—is typical of many. A freight train had to wait in a siding for four trains to pass, but came out after the third had gone.

It is a frequent occurrence in these bulletins to read of men being asleep. There were two cases in Bulletin No. 8, and two in No. 18, and another two in No. 24, and two again in No. 25. Then the cases of long hours are too numerous to extract. In Bulletin No. 18 there appear the following comments on the question of long hours :—

"In nearly or quite every accident Bulletin that has been issued it has been necessary to record one or more collisions due to the mistakes or negligence of men who had been on duty so many hours as to raise the supposition, if not the presumption, that they had become drowsy, if they had not actually fallen asleep; and cases in which enginemen are definitely reported as being asleep on duty are common. In the quarter covered by the present report (September—December, 1905) traffic was very heavy, and in some localities, according to common report, there was difficulty in finding additional men for the freight-train service as fast as they were needed and the reports make a very unfavourable record in this respect, culminating in a collision—No. 2 in the foregoing table of causes—in which a conductor who should have protected the rear of his train was asleep in his caboose, while the engineman of the following train was asleep in his cab, so that he would not have seen the conductor's red lantern if it had been shown. In collision No. 1 the engineman at fault had been on duty fifteen hours. In collision No. 8 an engineman, who had been in service as such only fifteen days, had been on duty fourteen hours, but with an intermission. In collision No. 18, before referred to, all the men on the train had been on duty sixteen hours forty-five minutes, with an intermission. Collision No. 10 was due to the fault of an operator who had been asleep, though

whether or not his mistake was due to this is not clear. Derailment No. 1, due to misconduct or neglect of a conductor and an engineman who had been on duty eighteen hours, may or may not have been due to overwork. Collision No. 22, referred to above, is also to be noted under this head. In the list of boiler explosions, which do not appear in Table 2a, there are also cases in which men were apparently overworked. In one such explosion the engineman, who was at fault for allowing the water in the boiler to become too low, had been on duty very irregularly for the preceding two days. After a rest of seven hours forty minutes he was on duty twenty-one hours; then rested two hours forty-five minutes; then was on duty very irregularly for the preceding the accident occurred. The way such a "schedule" of hours works out in practice may be seen by assuming the case of a man who finishes his work at 7 o'clock on Saturday night. If, then, he rests seven hours forty minutes, he will be called at 2.40 a.m. on Sunday; working then 21 hours, he will be off at 11.40 p.m. on Sunday. A rest of two hours forty-five minutes then would end at 2.25 a.m. on Monday, and working then for eleven hours five minutes would bring him to 1.30 p.m. Monday. In another case an engineman, who was dismissed from the service on account of his responsibility for the explosion, had been on duty sixteen hours forty minutes, following a rest of twenty-one

hours forty minutes. This man had been in the service of the company about ten years, but had been an engineman only two months. In another boiler explosion, which caused injury to 9 employees, and was reported as being due to the water becoming low in the boiler, the engineman held accountable had been on duty eighteen hours."

The quoting from these bulletins is getting wearisome, so the remainder will receive only a cursory glance. Collision 2 in Bulletin No. 21 is too good to be omitted. It reads:—"Collision at crossing. Signalman disconnected interlocking so that the signals could be set 'clear' for both roads at the same time, and went out for a social evening. While he was gone, yardmen disobeyed his verbal instructions not to enter upon the crossing." In the same Bulletin we read:—"Collision 20 was a butting collision due to forgetfulness on the part of an engineman 21 years old, who had been on duty 39 hours and 25 minutes. He had received a meeting order, but had put it into his pocket without reading it." Bulletin No. 22, whilst not so bad as No. 13, has a terrible record. No less than 180 passengers were killed in that quarter—ending December, 1906. One collision on December 30th, just outside Washington, at the doors of the Capitol—an empty carriage train ran into a standing train—causing 43 deaths. Another on the same line—the Baltimore and Ohio R.R.—also caused 43 deaths,

and was caused by a freight train leaving a side-track after the passage of the first section of an opposing train, and in ignorance that the latter was running in two sections. Then 57 persons were killed by an electrically propelled train becoming derailed owing to an opening bridge not being in proper alignment at Atlantic City. Then, lastly, there was the death of Mr. Samuel Spencer, President of the Southern R., killed on his own line, along with six others, in a collision due to a false "clear" block signal. The next Bulletin—No. 23—has another bad record of 126 passengers killed. Amongst these were 19 killed in the derailment of an express electrically propelled train at Woodlawn on the New York Central R.R. The cause for this was never clearly arrived at, but the Author came to the conclusion that the speed was excessive for the road at that point, coupled with the train having two electric locos. in front. Matters were further complicated by the lack of experience of the trainmen and others who had not the opportunity of getting thoroughly acquainted with their work and conditions.

In Bulletin No. 24 the number of passengers killed falls to 48, but it rises to 110 in No. 25, and then comes the period of slackness already referred to. It may be observed that Bulletin No. 26 gives the three following cases together:—"Engineman (killed) disregarded flag; had been on duty 28 hours." "Misplaced switch. Misplaced by brakesman of 7 months'

experience; on duty 18 hours 30 minutes." "Conductor asleep in cab; flagman also in caboose; these men on duty 13 hours 57 minutes."

The large number of derailments are undoubtedly due to:—The road not having been increased in strength to keep up with the greater weight of stock; insufficient maintenance of road due to the long stretches of uninhabited and uninhabitable country; the indecent haste and consequent carelessness of the staff in shunting. The reason for the large number of collisions may be judged from the foregoing. To a Britisher many of the methods in force may appear antiquated and no American officer would think of justifying some of them, as, for instance, having to rely on the accuracy of a watch; the display of the front light of an engine, etc. When the Author first went to America, in 1901, he was as prejudiced as most folk, but that visit and four subsequent ones have opened his eyes, and he recognises that there is some "method in their madness."

It must be remembered that out of 243,000 miles, roughly, of railway in America, 223,000 miles are single. Remember, again, that most of them were originally constructed to create traffic, and the end justifies the means. Many of them carry little traffic except at certain seasons, as when the grain or cattle are being sent to market. Our British methods of controlling single lines by an electrical tablet or

electrical train-staff will not suit, as they require operators at single line passing places, and many of these are situated miles from any habitation. In short, our ideas won't suit theirs, and this is more fully explained in the Author's *Power Railway Signalling*.

Much is, however, being done to equip both single and double lines with either automatic signals or the block system, and during the 15 months ending December, 1907, there were 5959.4 miles equipped with the block system, and 3976.1 miles with automatic signals, and there were then 47,875 miles protected by the block system and 10,803 by automatic signals.

The Inter-State Commerce Commission are anxious to obtain powers for the compulsory adoption of the block system. In the meantime some of the States have taken steps to further secure the safety of the railways which they control. In the Author's opinion the real reason for so many accidents is the inherent love of the American to take chances and his little respect for discipline and rule. We have seen how enginemen "thought" a train had passed. It will be a difficult task to eradicate this, which is a trait to be found in every walk of life. Another cause is the carelessness over his own life. Watch the men jumping on to and riding on the front truck—the cowcatcher—of a shunting engine and in all sorts of danger spots. Where the Author was staying in the summer of 1907 there was a crossing of the main

road over the Staten Island Railway. A watchman was employed, but he had no gates to protect the road, and he was withdrawn at 7 p.m., and from that hour until the trains ceased about 2 a.m. vehicular traffic took care of itself. One Sunday evening, about 8 o'clock, and after the watchman had gone, a carriage containing 5 people approached the crossing. A train was coming at the same time, but the carriage folk thought they could clear it, but they did not! That is a type of the indifference to human life shown everywhere and every day in America.

One of the disadvantages of this is that American railways get the credit for causing what is referred to as the slaughter on the railroads. But before dealing with that the Author will speak about trespassing. During the fiscal year ending June 1907 there were 6,695 persons "other than employees and passengers" killed on the railways of the United States. Of these 5,612 were trespassers. The law against trespassing on railways in America does not practically exist. People use the track as a highway. When at Schenectady once looking at the work in connection with the elimination of grade crossings on the New York Central, a man came up to the Author and said in broken English, and pointing eastwards along the track, "New York?" As Schenectady is 160 miles from New York the tramp had a good journey before him. Legislation to keep tres-

passers off the railway would greatly reduce the casualties on American roads; the extension of the block system will considerably help, but the greatest blessing of all is the hard times they are now passing through as it gives the men time to think not only of themselves, but of others, and learn in that hard school to appreciate the benefits of discipline. This would be a true blessing in disguise.

In the meantime other companies might imitate the example of the Southern Pacific and Union Pacific companies, and hold inquiries on which the public are represented to determine the causes of all accidents and allocate the blame. Were such inquiries held and the results freely distributed to the Press, as the above lines do, it would do a lot to make the truth known and to establish confidence.

CHAPTER XXII.

Conclusion.

What, then, is the conclusion of the whole matter? Has the Author proved his contention that whilst the accidents of 30 and 35 years ago were due to failures of the Machine that now the Machine is perfected, but the Man is at fault?

In former days there were not the safeguards that there are to-day—some were not invented or, if invented, were only just introduced, and whilst others, such as interlocking and the block system, were being used, their adoption was not general, and one reason advanced was that such would make the men less careless. This sounds very amusing to us in these days, but the users of the arguments were men of sound sense and able administrators. The slow progress that was made on some lines was not due to apathy on the part of the officers. They did not need the urgent appeals of Captain Tyler and his colleagues at the Board of Trade, who were, in a sense, preaching to the converted. They—the railway officers—soon saw the advantages, but it was the directors who were the stumbling block. After all, they were

responsible to the shareholders, and also held the purse-strings, and the officers having made the recommendations had the onus taken off their shoulders. This is what Captain Tyler said in a report he presented to the Select Committee of 1872, on the subject of Railway Companies' Amalgamation :—

> The officers of various degrees have in many companies been too much engaged from time to time pointing out, as far as they could venture to do so, alterations required, accommodation urgently needed, means of safety neglected, without obtaining the necessary attention until some actual block or some startling catastrophe confirmed the truth of their representations. The records of the Board of Trade for many years point strongly and continuously to the difficulty that has existed in inducing, especially the larger and more powerful companies, to adopt improved systems of working and principles of construction, even after they had been thoroughly tested by actual practice and introduced into every-day work and when they were of the most obvious character.

All that is now changed, and the most conservative companies of former days, such as the L. & North-Western R. and the Great Western R. are, taking all features into consideration, the freest from mishap.

Then, too, nearly all this has been done voluntarily and without legislative interference. True, there is the Act of 1889, but the Author has endeavoured to show in Chapter XII. that there was no need for this legislation so far as the majority of the railways were concerned.

As to the enactments relating to hours of labour, prevention of accidents, etc., it must be borne in mind that railways were not singular in this respect. It was only on lines with legislation as to mining, shipping, factories, etc.

Reference has already been made to America. It may also be worth while to quote some figures relating to Germany, where the railways belong to the State, and discipline is to be found to perfection. During the fiscal year, 1906-7, there were 1,346 derailments, 947 collisions, and 5,807 sundry mishaps.

The casualties to employees are still numerous, but it has been proved that rarely are any of these due to defective rules or systems of working, or to lack of discipline. As to train accidents the facts speak for themselves. It may be assumed that over 1200 million of passengers travelled during 1908, and none of these were killed in a train accident. Only one passenger for every seventy millions carried was killed in a train accident during the year 1907, and only one in every two-and-a-quarter million injured in train accidents. These figures would be all the more remarkable were season-ticket holders' journeys included.

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